Thom Hogan's

Complete Guide to the Nikon D80

1st Edition

By Thom Hogan
byThom Press

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1st Edition, version 1.03: 12/5/06

Acknowledgements

As with all my works, a draft was reviewed by volunteers to weed out unclear language and misstatements. My thanks to Bill Baburchak, Dale Bryson, Bill Creech, Linda McIsaac, Brian Stringfellow, and Ken Wagner. This eBook is better because of them.

Several Web sites proved useful in researching aspects of this book. While I mention several at appropriate points in the eBook, four need to be singled out for D80 users:

- Phil Askey's http://www.dpreview.com not only has some of the most thorough reviews of digital cameras (yes, even more thorough than the ones on my own site), but also has an ongoing forum that's useful for getting answers to tough questions (select **Nikon D80/D70/D50/D40** from the **Forums** pop-up in the left navigation panel).
- Rob Galbraith's forums, which I recommended in earlier editions of my eBooks, have been sold and are now part of a different commercial site (though you can still browse forum messages for free). Nikon D80 users should go to http://www.prophotohome.com/forum/nikon-digital-slr/.
- Nikonians http://www.nikonians.com is another of the "well-attended" public forums that are useful for Nikon D80 users. Click on **Forums**, register as a member or click on **click this link**, and then click on the **D80 Users Group** link.
- Nikon Café http://www.nikoncafe.com is a relatively new moderated forum and has had a discussion of the D80. Click on **Cameras and Gear**, and then click on the **Nikon D80** forum link.

About this eBook

This eBook was created using Adobe Acrobat directly from my original files. I've tried to retain as many of the navigational features as Acrobat allows (for example, the **Bookmarks** section at the left is derived from the Table of Contents and is fully active—click on an entry and you'll be taken to it). Curiously, trying to create a fully functional eBook using Adobe's tools is worthy of an eBook itself (most of the chapters would be centered on trying to get promised features to work, and how they keep changing between Acrobat Professional versions, sometimes going backwards in ability).

Your Rights versus Mine

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Printing the eBook

On to a more positive subject: if you'd like a hard copy of the eBook, you can print a copy for your personal use by selecting **PRINT** from the **FILE** menu.

It's possible to print on both sides of the paper and get a real book-like experience by using the **Print: Odd Pages Only** and **Print: Even Pages Only** options on the **Print** dialog, but I don't recommend this unless you're good at keeping track of paper, know how to properly re-orient the paper for the second pass, and are sure that your printer won't choke on a page somewhere.

Since there are so many printers available and their dialog boxes all allow different printing options, I can't help you figure out the most economical or convenient way to print your eBook[2]. Yes, it even took me a few minutes to figure out how to create front and back copies on my laser printer, so I know it's a hassle. A complete set of step-by-step instructions that work for the three printers I have available are included on the CD in a separate file, called PRINTING.PDF.

Take the resulting pages to your copy shop, have them trim the edges (the final page size is 5.5 x 8.5" unless you've let Acrobat rescale the book to fit the full page) and bind. This eBook is actually in three specific sections that could be bound separately ("Before You Take Pictures," "Shooting Pictures with Your D80," and "After You've Taken Pictures with your D80"); I've tried to keep the instructions you'd want while out shooting in the middle section.

[2]Since I get the occasional question as to *why* I don't publish a paper version, I'll explain: paper versions turn out to be more expensive to produce in the small quantities at which a niche publication like this sells. Producing this eBook electronically allows me to create it on demand, reducing waste and cost, and to keep it up to date as I learn new things about the camera. It also gives me a chance to correct the inevitable minor typos that somehow creep into every major production. On that last point: I keep a current errata list on my Web site. You'll find the one for this version of the eBook (1.03) at http://www.bythom.com/d80guideerrata.htm.

If you're really the type that doesn't like to struggle through the paper handling idiosyncrasies of your printer, most Kinko's and similar copy shops can print, collate, and bind a nice portable version of this book for you (show them the statement on the back cover or on the previous page if they balk at printing a Copyrighted work). Make sure they know that the final page size is 5.5" x 8.5".

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Note: Some Kinko's now use a special piece of software to print from PDF files, such as the one for this eBook. Since that software first attempts to extract all text from the file and I have selected to block text extraction in Acrobat, this means that such software fails to work with this eBook. Kinko's can still print it by simply running Acrobat, but this limits some of the fancier options they can do.

This eBook is designed to help you get quality results from your Nikon D80. While I'll try to provide introductory material that should help even a photography novice get by, this eBook probably isn't the place to learn what an aperture or shutter speed is (check out http://www.bythom.com/bookrecs.htm if you want some recommendations for general photography books).

Nevertheless, I will try to explain the concepts and terminology that are necessary to understand how a D80 works. If you find something in this eBook unclear, or that I've assumed knowledge on your part that you don't have, don't hesitate to drop me an email asking for an explanation. Not only will I answer your question, but it will give me some insight on what I might want to change in future editions to make the eBook even clearer.

Besides dealing with the practical side of the camera and showing you how all the basic functions work, I'll also provide you with some tips on how to squeeze every last bit of image quality out of your camera as well as how to make up for some of its shortcomings.

Note on the First Edition

While this is a first edition, the D80 is enough like earlier Nikon DSLRs that I've been able to re-purpose and rewrite portions of earlier eBooks—specifically the D200 eBook, as the D80 shares menu structure and many options with that camera—which means that much of the information here has been previously vetted.

One thing I have done with this eBook, though, is restructure it from my previous ones, and augment it with more introductory material. The audience for the D80 includes more first-time SLR[3] users, so I've worked very hard on making this work both more approachable and more understandable, even though my previous Nikon books have been highly regarded in that respect.

Since I mentioned the change in structure, let me point it out; this eBook is separated into three distinct sections:

- *Things you should know and consider before using the D80 (labeled "Before You Take Pictures" and starts on page <27>).* In this first major section I cover a lot about what a DSLR is, some of its critical components (like the sensor that captures images), how to set up your camera for shooting, and things you should do and know before you head out the door to take pictures. This section is up front because it's the background material you need to get up to speed with the unique aspects of your camera.
- *Things you need to know while using the D80 (labeled "Shooting Pictures with the D80" and starts on page <205>).* This is the "how-to" section of the eBook. Here's where I walk you through each feature of the camera as you'd use it. I'll explain why you might use it, how to make that feature active, and what your options are. If you're going to print only one section of this eBook and

[3]SLR stands for Single Lens Reflex, and I'll explain what that means on page <27>. You'll also see me use DSLR, or Digital Single Lens Reflex, to distinguish the digital bodies from the film bodies.

carry it with your camera, this is the section you'll want. Yes, you may find a few things repeated in this section from the first, but in the interest of making for a complete "how-to" section, I've elected to repeat some set-up and other instructions.

- *Things you need to know and do after you've taken your pictures (labeled "After You've Taken Pictures with Your D80" and starts on page <551>).* When you come back from shooting with your camera you still have things you may want to do, like transfer, print, view, organize, or improve your images. This is where Nikon's supplied software comes in, and you'll be at your computer for most of this type of work, so we'll be discussing computers and computer hookups here.

That also mimics the order you'll want to follow as you master your new camera: initiation, use, and post production.

As I wrote earlier, this eBook incorporates bits and pieces from earlier eBooks I've written about Nikon equipment. It's not easy keeping up with all the changes Nikon keeps making to its DSLR lineup and software, though, so if you have any of my previous eBooks you'll find that my words and explanations may have changed, even for features that were common across many models. So don't skip over anything—read everything here as it stands, not as you think it might be.

As I receive comments from readers of this eBook, I *update* the original file. Since I generate this eBook directly from my files, this means that I am usually able to keep the text nearly error-free while adding or modifying sections to make a point more clearly. Every now and then I make a *full* pass through the manuscript, augmenting what I've previously written with knowledge I've learned from using the camera, teaching workshops, and from other sources. When I do that, I iterate the "edition number." And when I create a new edition, I offer low-cost updates to people that bought the original eBook from me.

So, if you do find an error or confusing wording, take a look at http://www.bythom.com/d80guideerrata.htm to make sure that the problem hasn't already been discovered; drop me an email telling me about it if it hasn't.

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Conventions Used in this eBook

In this eBook I occasionally make comparisons between the D80 and previous Nikon models. In general, whenever this eBook uses the term D1 or D1 series, I'm referring to the entire D1 *family* (i.e. the D1, D1h, and D1x). The same is true of the D2 family (D2h, D2hs, and D2x). Use of an individual model name in the text indicates a model-specific feature or characteristic. In tables, if there are differences between the cameras, I've either added columns for each camera, or separated the information into model-specific tables.

Why am I including some D1 and D2 information in this eBook? Many readers own multiple DSLRs or have experience with previous Nikon models. Moreover, many D80 purchasers followed the earlier camera developments but held off buying one until Nikon came out with a camera that was less expensive. The introduction of the D80 was what they were waiting for, though the resulting camera is a bit different than the earlier models they learned about. Finally, it is just good form to know how your camera compares against other Nikon DSLRs.

When software products are mentioned, including those that Nikon supplies with the camera, I try to identify the version I used for this eBook when I introduce the product, and note any significant differences between versions that I think you should be aware of. If I refer to a software program generically, as in "use the **Unsharp Mask** in Photoshop," this usually applies to the entire range of Photoshop versions.

Specific instructions for software, as in "select **Remove Redeye** in the **JustDoIt** menu," are for the version current as of the publication of this eBook. Also, you'll note that I use a different font to distinguish menu items or messages that you'll see on the computer or camera screens—this makes it easier for you to differentiate what I'm writing about from what you should be seeing on your equipment.

Instructions that apply to using the camera are marked starting with a . Anywhere you see that symbol, grab your D80 and follow along!

As I have with all my previous books and eBooks, I use my Web site (http://www.bythom.com/d80guideerrata.htm) to report any corrections or clarifications of information or instructions (you'll also find some helpful product reviews and general articles). Write me at thom_hogan@msn.com if you have any questions or comments.

Thom Hogan
Emmaus, PA

Introduction

You've purchased a Nikon D80 camera and are looking for help in getting the best possible pictures from it. Or perhaps you're considering purchasing a D80 and want to know how it works and what it is capable of. Welcome. You've come to the right place.

First a little background for the newcomers: I've been using Nikon cameras most of my life and for the last dozen years have spent much of my time creating articles, books, and a Web site explaining the nuances of these cameras to others. Successfully, I think (I hope you'll agree by the time you finish reading this work).

You probably fall into one of three categories:

1. *You've never used an SLR[4] type of camera before*. Previously, you probably used either a 35mm or digital point-and-shoot type of camera. Those all-automatic, all-in-one cameras are small and convenient, but tend to be somewhat slower to shoot and limited in control. You probably decided to try a D80 to get away from one of these traits.

   Specifically, you're hoping that the autofocus is fast and accurate, that there's no delay between pressing the shutter release and the time the picture is taken, and that you can buy accessories that allow you to take pictures you can't with your compact camera.

   I'll cut to the chase: you'll be happy with your D80. But you've got a lot to learn, as SLRs tend to be more complex and sometimes require more decisions than

[4]Again, SLR stands for *Single Lens Reflex*. That may not mean a lot to you yet; the key point is that an SLR uses a mirror relay system (the "reflex" portion of the name) to let you see exactly what the lens is zoomed and focused on. Yes, there used to be a TLR (Twin Lens Reflex), which is a system where you look through one lens via a mirror system, and a second lens is used for taking the picture. The old Rolleiflex and Yashicamats are examples of a TLR.

do the automatic point and shoots.

If you fall in this category, you'll want to read this entire eBook very carefully—there's really no section you can skip over.

2. *You've used a film SLR before, but are just now switching to a digital SLR (DSLR)*. You probably picked the D80 because it was modest in price but big in features and quality.

   Your film SLR worked just fine, but you're looking for the advantages that digital brings: instant review, no wait for developing and processing, no per-image costs, and convenience for emailing and sharing pictures. You're probably a little worried about image quality—is a digital SLR like the D80 as good as 35mm film?

   Again good news awaits you: yes, you'll get all the conveniences you seek and give nothing up in image quality.

   If you fall into this category, you'll probably be able to skip over many of the early portions of this book (or read them as a refresher). But make sure that you start reading seriously with the section labeled "Camera Setup" on page <170>.

3. *You've used a digital SLR before, so the D80 is likely a backup or second body for you*. You may have picked the D80 because it looks like it might be a less expensive backup to a D200. And you'd be right—while a few features are missing and it's a little slower, the image quality of the D80 basically equals that of its older and more expensive brother, the D200.

   Or perhaps you've got a D50 or D70s and picked up a D80 to get more resolution (your older Nikon DSLR will become your backup body). Again, you'll find

that you've made a good choice. Your only worry is whether you can get up to speed with your D80 as fast as possible.

Your good news is that you've already got a huge head start on the others—you need only to brush up on a few odds and ends.

If you fall into this category, you can probably skim through the "Before You Take Pictures" section or perhaps skip it entirely. You'll want to read and print out the section labeled "Shooting Pictures with your D80" (see page <205>), and depending upon your familiarity with Nikon's software, you may want to also review the section labeled "After You've Taken Pictures with the D80" (see page <551>).

But don't worry, it doesn't matter which of the categories I've just described you fit into, you'll find everything you need to know in this eBook.

Before I get deep into each of the areas just mentioned, let me tackle a few common questions that novice D80 users ask:

1. *What's an SLR?* If you're the first type of user I described earlier—moving up from a point-and-shoot—we need to cover some basics so that you know how an SLR works before we get to the details of how a D80 works. Don't worry, this isn't an engineering textbook—I'll hit just those things you need to know and keep the language in terms everyone can understand. We'll get to the detailed answer of this question in the next section (see "What's an SLR?" on page <27>). If you've used a film or digital SLR before, you can skip that section or read it quickly as a refresher.

2. *How is digital different?* Film was easy: you took your pictures and then handed your film to a lab. The lab performed "magic" and made your pictures into good-

looking prints. Digital cameras can make great photos, too, but you'll want to know how it is unlike film and what you might have to do differently. I cover this in various places in this eBook, but the big differences you need to know about are in the section that begins with "The D80 Sensor" on page <62>. There I'll step you through everything you need to know about how digital works, which, thankfully, isn't as much as you probably expect. If you've read any of my other books on Nikon DSLRs or have DSLR experience already, you can probably skip that section, too, or at least read it quickly as a refresher. Shooting digital also forces you to pay attention to camera settings, in particular things like white balance and color characteristics. I cover those at the end of the "Metering and Exposure" section that begins on page <215>.

3. *How do you use a D80?* That's the question that probably drove you to this eBook. The bulk of this eBook is dedicated to answering this question. "Shooting Pictures with the D80" begins on page <205> and steps through every D80 feature telling you how it works and when you might want to use it. As I've noted before, this is the section of the eBook you want with you in the field if you're going to print out any portion of the eBook as reference.

4. *What do I do with the images I shoot?* In addition to the camera information in this eBook, the last major portion of this eBook ("After You've Taken Pictures with Your D80" on page <551>) details the software that comes with the camera, optional software you might want to consider, and the steps you perform

after taking a shot with your camera (something called "workflow[5]").

Finally, I should point out that something as complex as the D80 means that I can't easily introduce every term and concept you'll need to understand all at once. I also tend to make the assumption throughout this work that you know some basic photography terminology, such as "aperture" and "exposure." If for some reason a term or concept confuses you, don't hesitate to drop me an email asking for more explanation.

At the same time, if you're completely new to controlling a camera (e.g., you've always just used an all-automatic camera), you might want to also pick up a general book on photography. For that, I normally recommend you start with the classic: *The Camera*, by Ansel Adams (updated by Robert Baker)[6]. While Adams didn't use digital cameras, his explanations of the basic concepts are about as good as they get, and with the update, survive into the modern SLR world.

[5]It's called "workflow" because the things you do with an image file after you press the shutter release potentially *flow* through multiple software programs. Indeed, you have to get the image from the camera to your computer and then perhaps to a printer, so you have to "flow" the image through a chain of hardware, too. Despite the "work" part of the name, workflow can be fun and isn't always difficult or time-consuming.

[6]If you'd like to help pay to maintain the content on my Web site http://www.bythom.com, go there and click on the Amazon support link at the bottom of the home page, then buy any of the other books recommended in this eBook from Amazon. A small portion of what you pay Amazon comes to me, and that's the money I use to purchase Web space, services, and review equipment.

Before You Take Pictures

In this section I'll take the time to explain how an SLR body works, plus we'll look at the controls of the camera, how it's powered, how images are stored, and the important things you'll need to set up before you first use it.

I'll also present a short "what to do before you go out and shoot" section called "Camera Setup."

Overall, this is a section of the eBook that you'll tend to read once for the background and understanding that's necessary to use a sophisticated product like the D80.

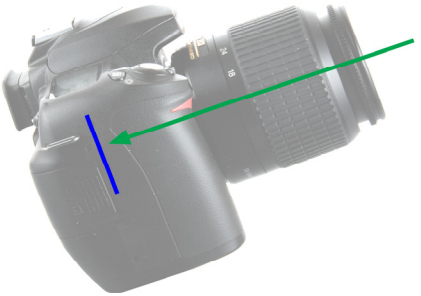
What's an SLR?

You're probably reading this section because you haven't ever used an SLR type of camera before, or else you want a refresher course on the basic aspects of how your new camera works.

Most modern SLRs—including the Nikon D80—use a traditional mirror and prism system to move light to the places it needs to be for image preview. The mirror moves out of the way for the actual picture taking.

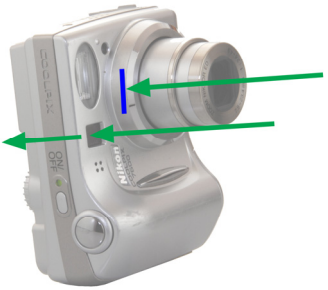
Light comes in through the lens and hits a large mirror that reflects most of the light up into a prism, which in turn reflects that light (and reorients it so that it's right side up) into your eye via the viewfinder eyepiece. When you press the shutter release, the mirror flips up out of the way, a shutter opens to reveal the sensor, and the light then goes directly to the digital sensor (or film in the case of a film SLR).

Before the shot, light (green arrows) takes a path through the camera that is reflected off mirrors (red) to get to your eye.



As the picture is taken, the main mirror moves out of the way and the light only goes to the sensor (blue). Thus, during the actual moment the picture is taken, the viewfinder "blacks out" for a moment, as no light gets to the prism.

By way of comparison, film point-and-shoot cameras have a separate viewfinder that you look through that *mimics* the view that the lens sees. Some such cameras have sophisticated viewfinders that zoom and move as you change settings on the lenses, but they're never perfectly aligned to the image. The most common problem is something called parallax, where what you see in the viewfinder is slightly offset from what the camera's lens sees.



In a compact camera, such as this Coolpix, light (the green arrows) goes separately to the sensor (blue line) and to your eye looking through a separate viewfinder (bottom set of green arrows).

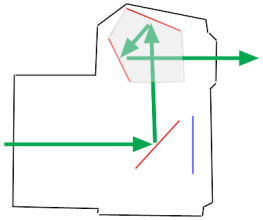
Digital point-and-shoot cameras often use this same technique, though most also show exactly what the digital imaging sensor is seeing by displaying it on an LCD as a "live preview" of the eventual image. A few now only have the LCD preview and skip an optical viewfinder entirely. The only problems with LCD preview are: it slows down the image capture (the camera has to switch from image preview to image capture, which isn't as simple as it seems); the color LCD is difficult to see in bright light; the user tends to move the camera away from their body in order to see the LCD and thus compromises stability; and the color LCD doesn't have a great deal of detail in it making it difficult to verify focus and even composition with really wide angle lenses.

So let's look more closely at the SLR design:

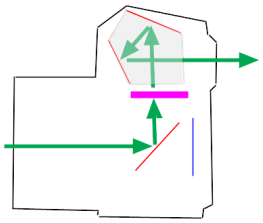
- The mirror and prism make it so that virtually all of the light collected by the lens makes it to your eye.[7]

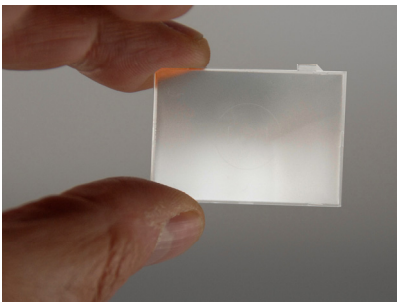
[7]Film SLR users may sense slightly less light in the D80 viewfinder than they're used to. The primary culprit is that the actual frame area of the D80 is smaller than film. A smaller frame area means less total light gets through (though the same amount gets through for any given spot; it's a bit of an optical illusion that it seems dimmer). Think of the lens as part of a water pipe and light as water moving at a constant speed. If you make the pipe smaller, you'll get less overall water. That's what's happening with the light you see in the viewfinder (which, is, after all, moving at a constant speed).

- The prism is necessary in order to flip the perceived image into the proper orientation (lenses reverse up for down and left for right, and we've got a mirror in the path which flips one axis but not the other). The prism has mirrored surfaces (red) to reflect light internally.



- Since the distance that the light travels via the mirror and prism to the eye is greater than the distance to the sensor (or film), we need an intermediary, called a focus screen (purple in illustration, below; shown removed from camera on the right, below). The mirror actually projects the image on the focus screen, which is the same distance from the mirror as the sensor, and the prism mechanism just acts as a viewing device so that you can see the focus screen.





- The focus screen shows the image as the sensor will capture it (well, close—the D80 shows 95% of the image area). You see basically the same thing the lens presents to the sensor when the shutter is open.

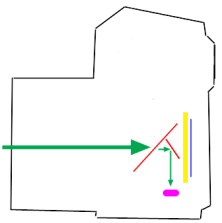
What you see through the D80 viewfinder, therefore, is a bright, complete rendition of what your image will capture. Because you're looking through the lens, you're seeing a real time presentation—there's no delay due to electronics, no degradation of the viewing quality due to electronics, and

you're seeing the current state of the focus system (don't worry, we'll get to the details of focusing soon enough).

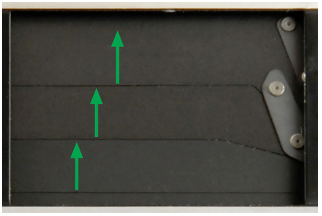
Here's a key difference between your D80 DSLR and a point-and-shoot digital camera: the point-and-shoot uses the digital imaging sensor to do multiple things: the imaging sensor provides autofocus and metering information to the camera's electronics, collects white balance info, and often even measures flash output. One of the delays on these cameras is that they operate the digital sensor at a specific frame rate while previewing the image and must take some last minute updates after you press the shutter release. As in "the user has pressed the shutter release so I'd better take one last look at whether the focus should be moved, grab one last metering measurement, and then turn off video stream for a moment, let the sensor stabilize, then take a picture." Phew!

The D80 uses dedicated autofocus and metering sensors; there's no delay because these dedicated parts work right up to the moment the camera flips the mirror out of the way. Amazingly, you can do a mechanical thing—flip the mirror out of the way and open a shutter—faster than you can do an electronic thing (at least for now with current technology).

We'll get to the autofocus and metering aspects of the SLR later in the book, but first we need to talk about what's behind the main mirror in your D80. It's not as simple as you might think. Behind the mirror you can see is a secondary mirror (small red line in illustration, below). We'll get to what it does in a moment. Behind the secondary mirror is a shutter (yellow bar in front of blue sensor).

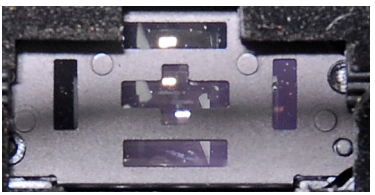


The shutter isn't a single "door" that hides the digital sensor on the D80. Instead, it's like a closed window shade, with multiple slats. These slats move out of the way from one direction and close from the same direction. Think of a curtain in a theatre moving up from the floor and eventually closing by rising from the floor.

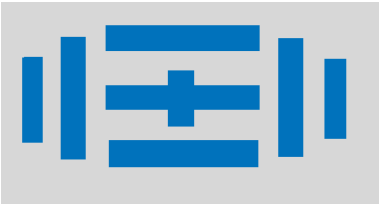


The secondary mirror probably surprised you. The primary mirror has several "partially silvered" areas. If you look at the main mirror with enough light (you'll need to take off the lens to do so), you may be able to see a rectangular area in the center of the mirror that's "discolored." That's the area that passes a tiny bit of light to the secondary mirror.

So why do we need some light going somewhere other than the viewfinder? As I mentioned earlier, SLR designs have dedicated sensors for many things. In the case of the D80, that light is bouncing off the secondary mirror down into an open area at the bottom of the camera that houses the autofocus sensors. At the bottom of the mirror box looking up is a set of autofocus sensors. If you could squeeze your head into the mirror box chamber and look down from the secondary mirror you'd see them. I'm not (yet) willing to take apart my D80 to photograph this part, but here's what the part looks like on the D50 and D70s (looking down from the secondary mirror):

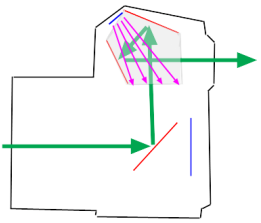


The D80's part looks more like this:



In other words, a small amount of light is split off from the viewfinder so that seven[8] autofocus sensing areas in the bottom of the mirror box get some light. You may have noticed that Nikon specifies that a lens has to be f/5.6 or faster (larger physical aperture opening) for the autofocus system to work. That's partly because the autofocus system doesn't get all the light coming into the camera, just a small slice of it that manages to get through the partially silvered area of the main mirror.

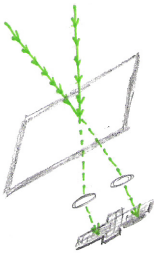
The D80 has another dedicated sensor besides the autofocus sensor array. In the prism area of the camera resides a 420-segment CCD[9]. This CCD (blue line in prism area in illustration, below) is dedicated to measuring exposure (both normal and flash exposure). It actually looks at the focusing screen at the bottom of the prism to get its slice of light (the purple lines indicate where it is looking).



[8]Yes, I said "seven." It appears that the inner vertical sensors are split into three for autofocus. I'll have more to say about this in the section on autofocus later in this eBook that begins on page <319>.
[9]*Charge-Coupled Device*. A CCD is a type of digital light sensor. Note that the D80 has two CCDs: one in the viewfinder for doing metering, and the main image sensor (see "The D80 Sensor" on page <62>).

Let's talk for a moment about the "order" in which things are done in an SLR. Remember, with compact digital cameras, they execute a sequence of things using a single sensor, which slows them down. In a DSLR, many things happen simultaneously once you've press the shutter release partway down:

- *You observe what the lens sees via the main mirror and prism*. This allows you to compose your picture or follow action.
- *The autofocus sensors get light through the partially silvered portion of the mirror and look for phase detection that indicates that the subject is in focus.* This is even more complex than it sounds as there are lots of focus options on a D80, but in essence, all seven autofocus sensors get information that has been split by separator lenses just on top of them (see illustration below). The sensors provide a stream of information about the separated data (distance between them) to the camera's main computer. The computer calculates whether the optimal "split" has been achieved; if it hasn't, it tells the lens to move its focus point, as necessary (if the lines are too widely spaced, the focus is in back of the best point; too narrow indicates focus in front of the best point; thus the camera knows which way to turn the lens).



Light (green lines) coming down from the secondary mirror reaches a plane that's the same distance from the lens as the sensor (large rectangle in above illustration) but the separator lenses are placed just below this, meaning that the focused light beam is already broadened a bit before it hits the separator lenses (two small ovals in the illustration). These lenses refocus the light to the AF sensor below. The light should be a known distance apart when it reaches the AF sensor. If the distance is shorter than expected, focus is in

front of the desired position. If the distance is greater than expected, focus is in back of the desired position. In practice, the focus plane, separator lenses, and AF sensing unit are all part of the same seven sensor AF part I mentioned earlier (in other words, we're looking at what happens in a cross section of the actual AF sensor here).

- *The 420-segment meter in the prism is capturing exposure info.* The dedicated metering CCD is concurrently providing a stream of exposure information to the camera's main computer. Based upon your camera settings, the exposure information is updated in both the viewfinder and the top LCD of the camera.

At this point the camera's computer is looking at all your camera settings plus the information streams coming to it from the various sensors and is making decisions about how to expose and focus the camera. So far, almost everything is electronic (the lens movement for focusing is mechanical). But the moment you press the shutter release all the way down, a series of additional actions occur, some of which are mechanical:

- *The flash may fire a preflash.* If the flash is active (up and ready for use) and set for automatic (TTL[10]) use, a very brief series of preflash pulses are fired from it and reflections off the subject from those flashes are measured with the CCD in the viewfinder. When I say brief, I mean brief. The preflash comes so close to the actual flash during the main image exposure that you can't usually see it. The preflash has to occur before the mirror moves because the preflash is measured by the CCD in the viewfinder.
- *The mirror flips out of the way.* This is the big physical action the camera makes and accounts for much of the sound you hear from a DSLR. When the mirror is out of light path, you no longer see what the lens sees (the viewfinder "blacks out" momentarily) and the autofocus

[10]*Through The Lens*. Stands for the fact that flash output is measured through the lens instead of by a dedicated flash sensor on the outside of the camera or flash.

sensors no longer get light. No need to worry though, the camera's computer had a stream of data from the autofocus sensors and can "guess" what the next data point might be—called predictive autofocus—so even if your subject is moving, the camera usually still focuses correctly on it[11].

- *The aperture is set.* Inside the camera there's an arm that physically moves to set the lens aperture (the opening in the lens that the light goes through) to the proper value (as set by you and/or the exposure system).
- *The shutter opens.* The curtain that sits in front of the main imaging sensor opens. The main imaging sensor itself is turned on and begins collecting light.
- *The flash fires.* If flash is active, it fires once the shutter curtain is completely open. The camera detects the point where the curtain is open and sends an electronic signal to the flash to start, and later, to stop (assumes TTL BL or Standard TTL flash, the usual methods we use with flash; Manual and Automatic flash modes only send a start signal to the flash as the flash itself figures out when to stop, and TTL FP fires the flash continuously in a low pulsing action from start of shutter opening to the end).
- *The shutter closes.* The curtain that sits in front of the main imaging sensor closes. The main imaging sensor itself is turned off and the data it collected is moved to the other electronics within the camera, where it is measured, manipulated, and saved.
- *The aperture is reset.* The activation arm returns to its resting position and the physical aperture in the lens is reset to the largest opening (so that the most light gets through to the viewfinder and sensing systems).

[11]A lot of the footnotes in this first part of the eBook, like this one, are really just reminders that things aren't always as simple as they first seem. Yes, there's a caveat to what was written above: it is possible to set the D80 so that it focuses once on a target and *doesn't* refocus if the subject moves. We'll get to the nuances of autofocus settings in the section on that later in the eBook, but for now just believe what I wrote.

- *The mirror returns to its normal viewing position*. The mirror returns to its main viewing position (and the secondary mirror unfolds behind it so that the AF sensors can again get information).

Here's the amazing thing: all that mechanical movement (mirror, shutter, and aperture arm) happens so fast that it can be done several times a second. And even when the D80 is operating at full speed (3 frames per second), the mirror is down in its viewing position more than half the time (it has to be for the metering and AF systems to work between shots).

I'll have much more to say about each and every one of the subsystems within your DSLR as we progress further into the eBook, but suffice it to say that the engineering that goes into designing cameras like the D80 is pretty sophisticated.

Before we move on, let's take one last look at some important generic items before we move to the specifics of the D80.

Photographic Terms That Are Important to Know

I've already introduced some terminology that's specific to photography, and in some cases specific to SLR cameras. This isn't a book called *Introduction to Photography*, so I don't want to get bogged down in basic photographic concepts (this eBook will already tax your reading capacity, as you'll be reading well over 700 pages). On the other hand, some of you are coming from cameras that automatically controlled some of these things and thus you may not have encountered the terminology. So before we go on, let's get some basic definitions out of the way for those of you new to all these terms.

Aperture. The physical opening in the lens that light goes through. This opening can be changed in size from very small in physical size to the full size of the glass used in the lens. Aperture blades (usually between five and nine blades that form a near circle) are used to make this adjustment. We refer to the aperture opening as an f/stop, as in f/2.8. Lower *numbers* make for *larger* openings. Thus, f/2.8 is a large

physical opening letting in a lot of light, f/22 is a small physical opening letting in a little light. Apertures are one of the ways we use to control the amount of light that gets to the sensor, and thus the "exposure" (see below). Common apertures you'll encounter go in the following sequence (all one stop apart): f/2.8, f/4, f/5.6, f/8, f/11, f/16, f/22. The D80 allows you to set these values and values that are either 1/3 or 1/2 stop increments between the full stops. The observant amongst you will notice those full-stop values I just listed are all 1.4x apart; if you memorize any photographically-related number, that's the one you want to remember, as it can be used for a lot of things[12].

Same lens, two different aperture settings (f/5.6 on left, f/16 on right; aperture opening shown here highlighted in red). This particular lens (a Tamron 90mm Macro) uses an opening defined by nine "blades" to approximate a circle. Note that you can see a bit of lopsidedness in the opening (especially true of the smaller aperture, at right). Badly mishapen openings or ones made with fewer blades can produce objectionable artifacts in the out-of-focus areas of your image. The Japanese refer to this as the "bokeh" of the lens.

Shutter Speed. This term refers to the amount of time the shutter is open and letting light hit the sensor. Shutter speeds go in increments a little more predictable than apertures, as each doubling of the time is another stop (doubling) of

[12]E.g., if you know the Guide Number of your flash for one ISO value, 1.4x gets you the Guide Number at double the ISO value; or: the light from your flash falls off one full stop for each 1.4x the distance it has to travel.

exposure. The commonly used shutter speeds go: 1 second, 1/2, 1/4, 1/8, 1/15, 1/30, 1/60, 1/125, 1/250, 1/500, 1/1000, 1/2000, 1/4000. The D80 allows you to set these values and values that are either 1/3, 1/2, or 1 stop in between.

Exposure. Think of the digital sensor as a series of buckets. Into each bucket (technically a photosite—we'll talk about that in "The D80 Sensor" on page <62>) light photons fall. But buckets have a fixed capacity and so too does our digital sensor. If we were to let too many light photons into the bucket, the bucket would overflow and we wouldn't be able to count the results accurately. Likewise, if too few light photons got into a bucket because we restrict their flow too much, we might not be able to count that level accurately, either, as we couldn't differentiate the number of light photons getting in and being converted to electrons from the stray electrons already there. Thus, we need a way to control how much light gets to the bucket. We mainly do that by changing the aperture (size of the opening letting light through) and the amount of time we let light in (shutter speed). When I talk about setting exposure, I refer mainly to setting camera controls for aperture and shutter speed to control how much light gets to our digital buckets. We're going to try to optimize that amount. Too much light and we have spillage we can't count. Too little and our counting mechanism can't distinguish light data from the residual in the bucket.

ISO. Sometimes referred to as the "sensitivity rating." Higher ISO numbers mean less light is needed to record an image. If we only get a little bit of light data into our digital collection buckets (see the description of *Exposure*, above), we may need to amplify that data so that it looks more like the image we want, so we set a higher ISO value. ISO values in film refer to more sensitive light receptors, but ISO values in digital always refer to a process of amplifying the data we record.

Meter. The mechanism that measures the amount of light in a scene. We also talk about "metering" the scene, which means we're using the facilities of the camera to measure the amount

of light hitting the scene. The process of metering establishes an exposure, and that exposure is a specific combination of aperture, shutter speed, and ISO sensitivity. (Are you starting to see that many of these terms are closely related?)

Stops. When photographers talk about "stops of light" (as in "I needed another stop to get the exposure right"), they're referring to a doubling or halving of light. Each additional stop of light—usually referred to with plus signs, as in +1 stop—means that they doubled the amount of light. Each removal of a stop of light—usually referred to with minus signs, as in -1 stop—means that they halved the amount of light. Stops and term *EV*[13] are used interchangeably by most SLR users; "increase the exposure by 1 stop" and "use +1EV exposure compensation" mean the same thing.

I'll introduce additional terms as we go along. For example, "white balance" is something that's important for you to know about when using a D80. We'll wait on some of these things until we get to the appropriate sections of the eBook, though. At this point I merely want to make sure that you and I have a common vocabulary on a few terms and concepts that come up often.

The D80's History

The Nikon D80 was the first time I remember Nikon ever "teasing" a camera announcement. In mid-July the Nikon Web sites started running a countdown banner with very few details. On August 9th, 2006, the camera was announced. The camera shipped to customers in most parts of the world in early September.

Overall, the D80 derives most closely from the D50 and D200, mixing the build quality and cost cutting measures of the former with the advanced imaging aspects of the latter.

[13] *Exposure Value.*

That should tell you something about the D80. It's the younger brother of the D200—not quite as mature and capable in some areas, but with the same DNA.

Along with the D80, two new lenses were announced. The first, the 18-135mm f/3.5-5.6G ED AF-S DX, is intended as an all-around travel lens. Nikon has packaged the D80 as either a body only or as a body with this lens (thus, we call this the "kit lens" as it comes in a basic kit Nikon makes available). The lens is targeted more towards a true amateur user: simple, light, and decent quality at a modest price. The second lens announced, the 70-300mm f/4.5-5.6G ED AF-S VR is a reasonable telephoto complement to the kit lens. Again, there's an amateur market target: no tripod collar, no fast aperture, and VR to help with using it handheld.

The D80 with the 18-135mm lens mounted.

Virtually every autofocus lens Nikon has made will work on the D80, as will most manual focus lenses (though metering will be disabled). No doubt Nikon will announce additional lenses that would be of interest to D80 users in the coming years. That's one of the joys of using an SLR-type of camera: different lenses give your camera different imaging capabilities. Nikon has made everything from fisheye (takes in 180 degrees) to exotic telephoto, from macro (close up) to tilt and shift lenses (to control perspective). No compact point-and-shoot camera has the lens versatility that SLR cameras do.

An Aside about Lenses

You're probably wondering about all those cryptic initials in Nikon's lens designations (e.g. "ED AF-S VR DX"). Nikon is pretty good at coming up with acronyms for just about everything associated with a lens design. You'll find a full description of the entire range of Nikon abbreviations on my Web site at http://www.bythom.com/lensacronyms.htm. But let's get rid of the primary lens designations in the lenses I just mentioned in the previous section, as they are ones you'll encounter often.

First up, we have the focal length designation (e.g. 18-135mm). This tells us a bit about how wide an area the camera can frame (see "Lens Angle of View" on page <314>). Roughly speaking, anything less than 24mm is considered a wide angle lens on the D80, anything over 55mm would be considered telephoto. Wide angle lenses are used to frame a large area all at once, telephoto lenses are used to isolate a single item and bring it closer.

On the left, a wide angle view of a Patagonian glacier (24mm lens used); on the right, a telephoto view of one small section of the scene near the lower right corner of the wide view (120mm lens used). Both photos taken from the same position; only the focal length used was changed.

Second we have a statement of maximum aperture (f/3.5-5.6). A lens stated this way has a *variable* maximum aperture, meaning that it has one aperture at one focal length (e.g. f/3.5

at 18mm) and a different one at another focal length (e.g. f/5.6 at 135mm). Good lenses for low light have maximum apertures of f/2.8 or lower (e.g. f/2 or f/1.4)[14]. The camera starts focusing more slowly when the maximum aperture of a lens gets near f/5.6[15] (and stops completely if you use a lens with a maximum aperture of f/8 because not enough light is getting through the main mirror to let the AF sensors do their job).

The view through the camera (remember we're looking through the lens) also darkens as maximum apertures get higher in number. The new lens with the D80 (the 18-135mm) ranges from the middle to the low end of brightness transfer. An f/2.8 lens would provide a brighter image in the viewfinder, as all autofocus lenses are always viewed at their maximum aperture, and f/2.8 would also allow more light to get to the autofocus sensors than f/3.5 or f/5.6 (the range of the maximum aperture of the 18-135mm).

Which brings us to those abbreviations:

- *G*—The letter following the maximum aperture value tells us that this is a lens that provides distance information to the camera, but has no aperture ring (a lens with an aperture ring would have a D in this location). D and G type lenses are the ones that enable the most features on the D80[16].

[14]A lot of confusing things come up in photography. One of them is that lens apertures get physically bigger (larger in diameter) as the numbers get smaller. Thus, a 50mm f/1.8 lens would have a larger maximum diameter lens opening than a 50mm f/2.8 lens. Almost all lenses allow us to choose smaller-than-maximum aperture openings, so that f/1.8 lens would allow f/1.8, f/2, f/2.8, f/4, f/5.6, f/8, f/11, and so on, while the f/2.8 lens would allow f/2.8, f/4, f/5.6, f/8, f/11, and so on.

[15]Thus my comment about the lens being "more amateur" in orientation than the camera. The D80 has a sophisticated, fast, and accurate autofocus system, but with the 18-135mm lens mounted on it and set to 135mm, the camera's autofocus system isn't nearly as responsive.

[16]Further compounding the confusion: third-party makers, such as Sigma and Tamron don't use D and G specifications in their lens naming. The lens databases on my site try to point out which third-party lenses are D-compatible. In general, all recent lenses are.

- *ED*—Refers to a type of low dispersion glass Nikon uses in many lenses. This special lens material has the primary property of focusing different colors at the same exact spot (regular glass tends to make different colors focus at slightly different spots, which can create a slight prismatic effect at hard edges in subjects). All other things being equal, an ED lens produces better quality images than a non-ED lens.
- *AF-S*—Lenses marked as AF-S have a focusing motor built into them instead of having to have their lens elements moved by a driveshaft via a motor in the camera. Such lenses focus faster and more quietly than lenses that don't have a focus motor built in.
- *DX*—Any lens marked DX is intended only for Nikon digital cameras. It has an imaging circle that's only big enough for the smaller digital sensors (35mm film cameras require lenses with larger imaging circles, see "Lens Differences When Used for 35mm and D80" on page <313> for more).
- *VR*—This type of lens compensates for vibration and motion, allowing you to handhold the camera and get good images at slower shutter speeds than you otherwise would. A 135mm lens handheld on a D80 should normally be used at a shutter speed of 1/200 or faster, but if the lens has VR, you may get acceptable images as slow as 1/30 second.

The new lenses that appeared with the D80 are rather well specified compared to the low-cost lenses that used to appear with film cameras. The new lenses have ED glass in them and an AF-S focus motor. More important, the telephoto zoom has VR. As you've just learned, these are all good things.

Back to the D80 Body

The D80 steals the best features from previous Nikon digital bodies, builds on the basic components of the D50 and D200:

- From the D50, the D80 gets the same matrix metering hardware, similar white balance ability, and the i-TTL flash abilities. These are done with a dedicated CCD in the viewfinder area. The Scene exposure modes are mostly carried over, as is the use of Secure Digital cards instead of CompactFlash.
- From the D200, the D80 obtains the basic user interface. While the D80 doesn't have the multiple Shooting and Custom Settings banks, it does have many of the other advanced features, including multiple exposures, direct Kelvin setting, selectable noise reduction, **FUNC** button assignment, and the sophisticated Commander mode option for the internal flash. Nikon has produced rather consistent user interfaces in their DSLRs—if you know how to use one, you'll be most of the way towards knowing how to use any other. On the hardware side, the D80 inherits the **FUNC** button, DOF Preview, Front Command dial, the big and bright viewfinder, the bigger color LCD, the EN-EL3e battery, most of the autofocus system, and a close relative of the D200's 10.2mp sensor.

There isn't much unique to the D80, as it cleverly combines things that were already in production with the D50 and D200. However, there are a couple of subtle, but important differences:

- The D80 most certainly doesn't have the D50's write-to-card mechanism. The time it takes to save pictures to Secure Digital cards is much faster on the D80 than the D50, and at 9.5MB/sec is specified at almost the same speed as the D2xs. In other words, the D80 has a faster card mechanism than the D50.
- The D80 has a number of in-camera image optimizations that haven't appeared yet in other Nikon DSLRs. Most obvious is the RETOUCH menu, which allows you to do quite a bit of post processing in the camera rather than on a computer. But the Black and White imaging optimizations also make it to the SHOOTING menu, where you can set them *before* taking a picture.

- Slide shows done from the camera now allow choices of transitions and background music.

If this all sounds like it might be a technological powerhouse in a small package, you're right, it is. And you'll note that Nikon is pretty good about standardizing on technology across their lineup. While the D80 isn't as capable as a D2xs, it's a lot closer in ability and function than most people at first guess.

Like every Nikon DSLR before it, the D80 was a much talked about camera long before it arrived in users' hands. The initial US$999 street price will surely attract a new generation of photographers shifting from 35mm film to digital as well as existing DSLR owners wishing to upgrade from 6mp cameras (e.g. D50, D70 series, D100). While I saw a large influx of 35mm SLR users arrive when the D100 first shipped, the D70 turned that initial rush into a stampede, and the D80 and D200 are probably going to catch the remaining holdouts.

But What about Film?

Some of you reading this may still be pondering whether or not to make the big switch from 35mm to digital. The thing that usually holds serious users back is their fear that there isn't enough resolution in digital cameras. The argument that 35mm film provides more resolution than the D80 series, while potentially true, is a bit misleading.

Technically, there are still plenty of reasons to use film. The largest file a D80 generates contains about 10 megapixels. While digital scans from 35mm film can produce far larger files, they don't necessarily resolve more detail. For example, Nikon's own midrange desktop scanner, the Coolscan 5000, generates files from 35mm film slides with a far higher pixel count and color depth than a D80 shot, but if you were to look at the finest detail rendered by each, you might be surprised to find that the D80 resolves that detail slightly better, and without revealing grain patterns.

In practice, I don't see major differences of resolution between film and the D80 showing up in prints, especially at the sizes most people print at. Most of the amateur world wouldn't be able to tell the difference between well produced prints from film or a D80. Even pros might have difficulty at that.

Still, almost everyone who ponders purchasing a D80 asks the same question: "is the resolution as good as 35mm film?" Some ask this question in a slightly different way (e.g., "can I get professional results with a D80?"), but the issue is essentially the same: just how good are pictures you take with a D80 compared to those with a 35mm film camera?

As I previously noted, on a pure pixel level 35mm film can still win. Let's look at the numbers more closely. The D80 generates a maximum of 3872 x 2592 pixel images with 12 bits of data per color channel. The Nikon Coolscan 5000, generates 5782 x 3762 pixel images with 16 bits of color data per channel from a full 35mm film frame (expensive drum scanners generate even larger files). Thus, one would be tempted to say that the D80 is, at best, *one-half* as good as 35mm film on a middle-of-the-line desktop scanner (10 megapixels versus 21 megapixels, with only three-quarters the color information at any point). But that wouldn't be completely accurate[17].

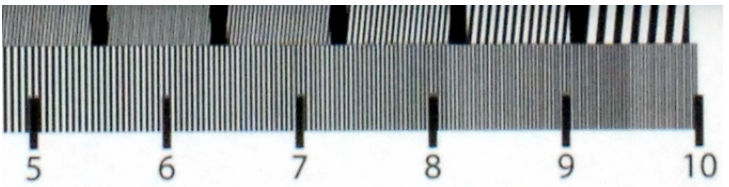
Let's try another way of looking at the issue. Most pros tend to believe that the very best film can be scanned at up to about 4000 dpi. Anything less than that (say 3000 dpi) leaves a small bit of detail behind; anything above that (e.g. 5000 dpi) doesn't resolve any additional detail. The long axis of the D80's sensing area is just a tad shy of an inch and it resolves 3872 points in that distance. In other words, the D80 is

[17]There's also a school of thought—which I subscribe to—that believes that lack of "noise" in an image is more important than additional resolution. Our eyes and brains are very sensitive to "detail," but false detail (noise) can be very distracting. To demonstrate this in action, one only has to compare an enlargement from a scan of a grainy film to one from a low-noise digital camera.

working at somewhere around 4000 dpi at the sensor, or about the same value you could get from film in that same area scanned on the very best equipment available.

True, the 35mm frame has another half inch of width over the digital sensor, but the cleanliness of the digital detail versus the grain in the film detail makes things about a draw, as far as I'm concerned. I've heard people describe the D80's resolution as anywhere from about 100% to 125% of film, perceptually, and I'd tend to agree it's in that range.

Unfortunately, it's not quite so simple to just state a resolution "number" like I just did in the last paragraph. Digital cameras do well up to a point, and then they "break down" in terms of resolving objects. If you photograph a black and white test chart (see example, below), you'll find that the digital camera simply does far better than the film camera up to the point where digital sampling artifacts get in the way. In other words, there's a difference between what happens when detail goes beyond the resolving power of an analog device (film) and a digital one (a DSLR such as the D80).



On such test charts, the digital camera generally has higher contrast and clarity up to the point where the pattern becomes close to or slightly less than the sampling frequency. Note how the big, diagonal lines above the "10" in the above example are resolved well but as we get to smaller and smaller versions (to the left) the lines start getting "beat frequencies," or false line reflections (very obvious in the diagonals above the "5" and "6"). (See also the example shown in "Sharpening," on page <332>).

The anti-aliasing and Bayer filters digital cameras need (see "The D80's Sensor" on page <62>), unfortunately, complicate

calculating exactly where the real resolution versus false resolution changeover occurs. As you can see, once the samples are too small, it might look like detail is being recorded, but this is false detail—mostly artifacts[18] that mimic detail. Film, being purely analog in nature, has no such problems. At some point grain effects become visible and compete with detail, but essentially film doesn't have the same kind of "break point" as does digital. Of course, if you scan the film digitally, all bets are off!

At the other end, we have print technology to contend with. Most digital color print technologies max out at slightly more than 300 dpi (dots per inch). Inkjet printers often only need about 240 dpi; even the top print technologies generally don't go beyond 360 dpi). At 300 dpi, a D80 file generates a print size approximately 8.5 x 13" (>ISO A4). The re-sampling techniques used in Photoshop (or used with a program such as Genuine Fractals) can easily generate images twice the original dimensions with invisible artifacts (essentially unnoticeable at viewing distances), so 17 x 28" prints are easily obtainable using D80. That, by the way, is larger than the consumer Epson printers (1800, 2200, 2400) can produce (they max out at 13 x 19").

Note: Those of you who own an Epson or other inkjet printer probably read that last paragraph and said, "but wait, my inkjet says it prints at 1440 (or 2880) dpi." A close reading of the Epson literature, however, shows that their printers don't necessarily place that many dots every inch, but instead use a spray adjustment technique to simulate that resolution (the size of the dot is varied). When moving the paper the Epson technologies max out at increments of 1/720 of an inch. The practical physical resolution you need to give the Epson inkjets is about 288 dpi; beyond that and the actual gains are subtle and often not at all visible. Other

[18] *Artifact*, used in this context, means an unwanted visual side effect. Digital imaging is full of artifact-producing technologies—the analog-to-digital conversion, sharpening, noise, and JPEG compression, for example—but for the most part these artifacts are extremely small and subtle and don't impact image quality in ways that most people can see. Certainly you can't see these artifacts by casual, arm's length observation.

maker's printers are similar. While it's a bit out of the scope of this book, there is a reason why printers use higher dpi settings during printing. Note that you can present the printer with 288 dpi and still have it print at 1440 dpi—the printer driver does a very good job of creating the additional information, and with high quality papers you can usually see a small difference if you look closely. We'll talk more about printing in the last section of this book.

So, the question really should be addressed in a different way: how do you intend to use your images? If the answer is that you're going to print them on an inkjet printer, virtually any difference you see between a D80-generated image and a scanned 35mm film image is going to be subjective, not objective. Most photographers I know say the D80 image is actually better, as the sampling artifacts of the CCD are less objectionable than those from desktop scanners. The D80 image also tends to have less noise[19] in the Red and Blue channels than most low-cost desktop scanners and no grain, especially if you're comparing ISO 800 from a D80 with ISO 800 film from a film camera.

Nikon's DSLR models and Kodak's recent DCS series of cameras have changed the minds of quite a few Nikon mount professionals. Wedding photographers have been especially drawn to digital cameras because of the quick turnaround and ease of touchup they allow. Photojournalists have virtually all switched to digital, again because of the fast turnaround for images (and the ability to send them in by modem from the field) coupled with no incremental film expense. Many wildlife photographers have switched to digital because it makes their big lenses work as if they were even bigger (the 10-pound 400mm f/2.8 functions more like a 600mm f/2.8; where else can you find such glass?).

In short, if you want the very best available resolution, consider going to a medium format camera (and paying the

[19]I'll detail what noise is and how it gets generated in the section entitled "Noise" on page <75>. Until then, think of noise as inaccurate detail.

price of doing so). As far as 35mm film versus digital goes, the race favors digital for moderate print sizes, due to the lack of film processing and scanning costs. And yes, I've put my pocket book where my mouth is: with the introduction of the Nikon D1x in mid-2001 I stopped using most of my film-based cameras and now shoot nearly all digital. I normally use a D2xs or D200 in my shooting.

Debunking Some Myths

If you haven't already purchased and started using a D80, you've probably been perplexed over some of the contentious and sharply worded posts on some Internet forums concerning several D80 traits, or the rumors that seem to float through some photo shops. Indeed, you may have purchased this book in an attempt to determine which claims are true and which aren't. Here's my quick take (some of these things are revisited in detail later in the book):

- *Battery life isn't great.* Nikon's manual gives two examples ranging from 600 to 2700 shots per full battery charge. The first example assumes flash used half the time; the second doesn't use the flash and has some additional constraints. First reports from users achieved nothing close to the 2700 number. A few things need to be noted: Nikon's numbers are without VR, which drains batteries more quickly. Also, new EN-EL3e batteries do tend to improve a bit after several charges, especially once the internal clock battery of the camera has been charged up fully. A lot of early D80 users also spent more time looking at the color LCD. Still, don't expect 2700 shots, especially if you shoot NEF files instead of JPEG. My battery life drops when shooting NEF, all else equal.

  In practice, with extensive VR, AF-S, NEF+JPEG, and modest color LCD and flash use I've been averaging over 500 shots a charge. That means that I usually get a full day of shooting on a single battery. The bad news is that if you're an intensive user and are far from your charger, you'll need to carry extra batteries with you. Event

photographers, who shoot high quantities of photographs in short periods, will absolutely need to carry more batteries with them than they do for the D70s or D2xs, for example.

Bottom line: battery consumption is higher for the D80 than it has been for some other Nikon DSLRs, but is quite acceptable, especially since carrying an extra battery isn't much of a burden.

- *The D80 has a hot pixel problem.* Hot pixels are photosites that present false light data because electrons are retained in the sensor when they shouldn't be. If you take a photograph with the lens cap on, for example, you'd expect the entire frame to be black. Hot pixels would normally show up as bright white, red, blue, or green points in the black, and are usually the result of the photosite well accumulating electrons not produced by light (or the sensor holding onto electrons between shots). The D80 definitely can be provoked to create hot pixels. Most cameras can; the difference is in what it takes to cause them and how prevalent the hot pixels are. The bad news is that the D80 is one of Nikon's worst performers in this area since the D1x. As you get into exposures measured in seconds, hot pixels dramatically increase on the D80 (they generally don't appear on exposures shorter than a half second).

  Bottom line: For exposures longer than eight seconds, make sure you've turned on **Long exp NR**, which dramatically reduces the hot pixel output. But the bad news is that the D80 is not particularly well-suited to long exposure, astronomy, or night exposure work.
- *It's not full frame.* The argument that a sensor has to be 24mm x 36mm (the same size as film) just doesn't play for me. Ostensibly, there are two reasons that proponents give: (1) bigger sensors mean bigger photosites which means less noise; and (2) full frame means that focal lengths work like you expect them to. I suppose you could add "more resolution" to the reasons, but I've already

noted that the D80 easily holds up against the resolution of film. Meanwhile, the D80's noise is well controlled, so the notion that the photosites have to be larger also doesn't seem to have much traction.

As for focal lengths working one way, yes, if you're moving back and forth between a 35mm body and a D80, that could be problematic. But who does that? Nikon's provided us with plenty of wide angle options (with more coming), so it's not as if there's much we'd want to do focal-length wise that we can't. Any format/focal length relationship has been arbitrary. The D80 is no different. Better still: the D80 is using only a portion of the imaging circle of most Nikkor lenses, so the edge problems—softness, vignetting, chromatic aberration—that some have seen with the Canon 5D simply aren't there on a D80.

Bottom line: get used to the change and re-align your lens arsenal with a few DX lenses.

- *The Sony Alpha 100 has anti-shake and anti-dust mechanisms built-in, uses the same sensor, so is a better camera*. Choosing any digital camera is a matter of selecting features that are useful to you and balancing that against the image quality produced. Here's the kicker: despite using the same sensor, the image quality produced by the Sony Alpha 100 clearly isn't the same as that produced by the Nikon D80. I personally think that Nikon's imaging with that same Sony sensor is better, and that this shows up more as you use higher ISO values.

  That's not to bash the Sony—it's a perfectly fine camera in its own right. It has some features the Nikon doesn't, and vice versa. However, in most users' hands neither is going to be significantly "better."

  Bottom line: My usual suggestion is to try all cameras at your price point and go with the one you like better from a handling standpoint.

- *The D80 overexposes.* Many matrix metering users make this claim, though they don't seem to be fully aware of the things that are driving them to that conclusion. First, the D80's matrix metering system gives high priority to the areas under the AF sensors. Second, the default **Tone Compensation** and other settings influence the results a bit. I'm not a fan of the "set -0.3EV exposure compensation" claims that some suggest, as that is not quite addressing the issue and can lead to underexposures in some conditions, but it seems to work for many D80 users.

  Bottom line: Nikon's matrix metering on the D80 is still quite good, and better than those of other systems I've tried. But if you want more consistent and precise exposures, you'd be using center-weighted or spot metering, anyway.
- *The D80 only has a flash sync speed of 1/200.* This is, of course, true. The protests come because the D50 and D70 series had flash sync speeds of 1/500, so many think this is a major step backwards. In reality, the exposure at which you can no longer fully sync the flash is only a third of a stop less on a D80 than the D50 (1/200 at ISO 100 is the same as 1/400 at ISO 200). Moreover, the D80 supports FP flash with the SB-600 and SB-800 (FP is a lower power TTL ability available at *any* shutter speed).

  Bottom line: Yes, there are some situations where you'd still like the 1/500 limit, but overall I don't find the lower sync speed to be nearly as limiting as some suggest.
- *The D80 uses Secure Digital cards.* This too, is true. The rationale behind complaining about this feature is that the D80 uses a different kind of card than the D200, which means that it's a less-than-perfect backup camera for D200 users. Those choosing to upgrade their D70 series body to a D80 also complain, as the cards they were using won't work in the D80.

Bottom line: Given the ever dropping price of storage cards—I was able to find a 4GB 150x card for US$58.99 (after rebate) on the day the D80 was announced—I just don't see this being an economic issue of any note.

If you were to believe the posts in some Internet forums, the D80 is a terrible camera with a defective design and not worth the money. I completely disagree. If I were told I could only use a D80 for the next two years, it wouldn't upset me greatly. Sure I'd miss some of the speed of my D2xs, but handled properly, the D80 can produce quite stunning images. Moreover, the D80 comes mighty close to what the D2xs can do for a little over one-third the price.

Funny thing is, *every* DSLR camera that gets introduced these days seems to gets its share of criticism on the Internet. Indeed, a word has popped up to describe some of these hyper-critical folk: measurebators[20].

That's why an eBook like this one is so important: I'll deal with the abilities of a D80 in a practical and no nonsense manner, hopefully explaining along the way why "digital" does not equate to "perfect" and how you can use the D80 to consistently produce high quality images regardless of any of its minor imperfections. No such thing as a perfect DSLR exists—but you can perfect the way you use your DSLR.

The bottom line is that the D80 is a very capable camera at a modest price that, with the right settings, produces state-of-the-art digital images. My goal in this eBook is to help you do just that.

[20]Definition: folk who get intense self-pleasure from repeatedly measuring camera abilities in minute detail rather than from the pictures they take.

D80 Basics

In this section we'll look at the controls of the camera, how it is powered, how images are stored, and the important things you'll need to set up before you first use it.

D80 Design

The D80 is a variant on existing Nikon body designs. Nikon has mostly taken parts from the D50 and D200 bins and integrated them in some modest body and frame changes to produce the D80.

The basic D80 body design appears to have come from a minor modification of the D50. The size and control placements are similar, though there are added controls (Front Command dial, **FUNC** button, Depth of Field Preview button, etc.). The use of Secure Digital cards, the IR receiver, and the access doors and flaps are also reminiscent of the D50. The 420-pixel CCD for metering is also a part that first appeared in the D50.

Still, a number of D200-derived parts show up. The viewfinder and color LCD are direct lifts from the D200, for example. And the most critical element, the imaging sensor, is essentially the same as the D200, but with only two-channel readouts instead of four. A close look at the imaging chain (sensor→ADC→demosaic ASIC→memory[21]) also reveals that the D80 uses the D200 style data flow, and most of the same parts.

[21] Don't worry, I'll hit all of this in detail in the section on the D80 sensor beginning on page <62>.

The D80 (middle) basically derives completely from the D50 (left) and the D200 (right). As such, you'll note that some things are D50-like (e.g. IR receiver) while others are D200-like (e.g. Depth of Field Preview and **FUNC** *buttons, though located in slightly different positions).*

The D80 uses the same mount for interchangeable lenses that Nikon has used since the first F-series camera, introduced back in 1959. While Nikon has made subtle improvements to the mount to support electronic exposure calculations, autofocus, and vibration reduction, the physical attributes have remained virtually unchanged. This allows D80 owners to use virtually any manual focus or autofocus lens Nikon has made (for a list of the very few that can't be used, see "Lens Compatibility" on page <316>).

One significant drawback to lens usage exists: the D80 body cannot meter with older, non-CPU manual focus Nikkor lenses (see "Lenses and Focusing," on page <308>). The D200 *can* meter with these older lenses, so if you have a lot of manual focus Nikkors, you might want to consider the D200 instead of the D80.

The D80 retains the "button and command dial" interface for most major controls that was first seen on the N8008 and F-801 in 1988. The D80 also uses a derivative of the exposure system first found on the F5 and D1 series. Finally, it includes most of the autofocus capabilities of the D200.

As I noted, the D80 shares the D200 viewfinder design. This design is not quite as friendly to eyeglass wearers, but shows a bigger and brighter image than the D50 and D70 series cameras.

As with the front, the back of the D80 (middle) looks like a hybrid of D50 (left) and D200 (right). The buttons and controls are mostly those of the D50, while the viewfinder is clearly from the D200.

In short, the D80 will be remarkably familiar to anyone who's used a recent high-end Nikon 35mm film or digital SLR. If you're used to an F5, F6, D1 or D2, you'll even find most of the major shooting controls are in the same place on the D80, and offer much the same set of options. If you've used a D200, the similarities are even more apparent, as the D80 controls are mostly a slight simplification. Really only users of the D50 will find any substantive change, and those changes will almost all be additions to the controls.

So, what's different about a D80? Let's take this in steps. If you're coming from a film camera such as the N80 or F100 the primary visible differences are found in three areas:

- On the back of the camera you'll note a large color LCD and additional buttons for the digital functions, while some of the shooting controls you're used to have been moved to slightly different positions.
- The camera back no longer opens as it does on 35mm film models, but several new "doors" and connections are present. The door on the right side of the camera houses Secure Digital storage media (see "Image Storage" on page <104>), while the small rubber "doors" on the left reveal new connectors that allow the D80 to be hooked up to a TV, computer, USB device, or controlled with a wired remote.
- The battery compartment no longer accepts AA batteries. You must use an EN-EL3e Lithium-Ion rechargeable

battery. (In the US, D80 models are only sold with an EN-EL3e and charger.)

The D80 also sports many internal changes from the film cameras:

- In the mirror box inside the camera, the shutter mechanism has been altered slightly. While the mirror, autofocus system, metering system, and shutter curtain remain, many of these have been modified significantly for improved performance. The D2 series mirror system has the shortest viewfinder blackout time of any Nikon SLR made to date (a trait shared by the F6), but the D80 is no slouch, with a faster blackout than the consumer film SLR bodies Nikon has made. The shutter itself has seen some modifications: no second physical shutter mechanism exists behind the primary curtain; when the curtain is open, a small digital sensor is revealed instead of film. And the shutter lag, at 80ms, is better than the consumer film cameras. One thing that isn't visually apparent is that the D80 uses a 420-element CCD in the viewfinder as the main means to measure flash. Unlike film bodies (and the D2 series), the D80 does not have a set of flash sensors in the mirror box to support TTL. This means that i-TTL capable flash units (e.g. SB-600 or SB-800) are required with the D80.
- All mechanisms associated with film transport have been removed. Mechanically, a D80 is even more reliable than the rugged F100.
- While the CPU and software that run the film SLR's controls remain (albeit substantially updated), they've been modified to deal with the all-electronic nature of the D80, plus additional electronics have been added. In particular, the D80 models have added internal memory buffers, a multi-channel analog-to-digital converter (ADC), a dedicated digital processor with software to analyze and interpolate pixel data, plus additional I/O support. Top that off with new control software that uses the Direction pad, new buttons, and the color LCD to provide additional camera options and image review.

Thus, one should conclude that Nikon has done a considerable amount of camera engineering since the F5. Whereas the F5 was a modest step above the F4 that preceded it, the D1, the D2, and now the D80 represent larger steps beyond their predecessors. Indeed, even F5 users would covet virtually every non-digital aspect of the D80: faster autofocus, better flash metering, more power options, and even better body ergonomics.

If you're coming from a previous Nikon digital SLR (DSLR), the D80 still represents plenty of change, especially if you're coming from one of the previous consumer DSLRs (D50, D70 series, D100).

Here are the primary differences between the D80 and the camera it was mostly based on, the D50:

- *New Sensor.* Both the D50 and D80 use a CCD sensor technology made by Sony; but the D80's sensor is now 10mp versus the 6mp of the older camera. It also features a two-channel ADC to move data off the sensor faster than before. *The benefits*: increased resolution, faster shooting speeds, and better image quality.
- *New Power.* Gone is the simpler EN-EL3 battery. In its place is an "intelligent"[22] variant of that Lithium-Ion battery, the EN-EL3e. Battery performance hasn't been particularly increased by the change, but the intelligence provides abilities that weren't in the older battery. *The benefits*: precise readings of battery charge, exact end-of-life prediction, less likelihood of cell imbalance shortening the battery life.
- *New Shutter.* Surprised? Yes, the older Nikon consumer DSLRs used a relatively inexpensive and simple shutter that never went faster than 1/90 (faster shutter speeds were done electronically). The D80's shutter does all shutter speeds mechanically, and produces both lower viewfinder blackout time and shutter lag (80ms). *The benefits*: even at

[22]Intelligent refers to the fact that the battery can be queried for its exact status.

3fps you can usually follow action in the viewfinder, and the camera overall feels as almost as responsive as the pro Nikon bodies.

- *New Autofocus*. The CAM-1000 module used in the D80 provides remarkable coverage of the frame with 11 focus sensor positions in the viewfinder. Unfortunately, this new sensor design is arrayed differently than previous Nikon bodies (other than the D200), so requires study. The good news is that it is more sophisticated and customizable than the simple CAM-900 system used in the D50, D70 series, and D100. The D80 shares the fastest focus calculation and anticipation capabilities of any Nikon SLR, meaning that it simply doesn't take long to focus and focus rarely hunts (at least with AF-S lenses, for which the system is optimized). *The benefits*: more control over the autofocus system, and better performance.

Amazingly, there's more: write-to-storage performance has been substantially improved from the D50, and dozens of other more subtle, less detectable changes have been made.

Up through the F5, Nikon's major product cycle generally took about eight years between substantive engineering changes. With the D2 series, this cycle dropped to three years, yet many of the changes are more dramatic than ever before. In the consumer DSLR bodies, Nikon is iterating on an 18-month timeline. On the Internet you see plenty of criticism about how slowly Nikon is moving, or how Nikon is falling behind (usually in relationship to Canon), or how Nikon isn't innovating. My analysis shows the opposite: Nikon is moving faster than ever and leaving no stone unturned.

Nikon DSLRs have pioneered a huge list of firsts and the D80 has revealed another handful of those (the RETOUCH menu is unique amongst DSLRs as I write this[23]).

[23] And not long after writing that, Nikon announced the D40, which also has a RETOUCH menu. It's likely other Nikon DSLRs introduced in the future will have it, too.

In short, while much of the visible D80 resembles earlier Nikon bodies, there's a lot more going on inside the camera than any previous Nikon consumer camera body, and the D80 is a lot closer to the D2xs in capability than many people think.

The D80's Sensor

The key element of any digital camera is the image collection device, called a sensor. In the case of the D2xs, that is a CMOS (*Complementary Metal-Oxide Semiconductor*) sensor made by Sony, apparently with Nikon's design input. In the case of the Nikon D80, it's also a Sony sensor, although this time it's the Sony ICX493AQA CCD (*Charge Coupled Device*). While the D2xs and D80 sensors are similar in resolution, much of the image quality differences between the two are explained by the CMOS versus CCD change.

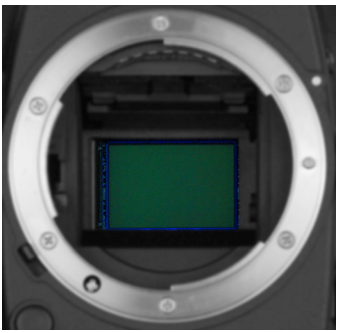
Sensors all work in basically the same way: they have light collection areas, called photosites, which are sensitive to light photons. CMOS, CCD, and LBCAST[24] refer primarily to the transistor type and underlying electronics methodology used to do the collection and transfer of light data.

CMOS is likely the long-term winner in the sensor wars. While it is more difficult to design (especially for high speed transfers, as are used in the Nikon D2 and Canon 1D series), the manufacturing costs are much lower. You can also design more electronics into the sensor itself. But CMOS has the problem of being inherently noisier than CCD technology, all else being equal (see "Noise," on page <75>). CMOS is also somewhat more difficult and costly to engineer, since it allows photosite-level electronics and the external circuitry addresses each photosite individually.

[24]The Nikon-designed sensor used in the D2h and D2hs. LBCAST stands for *Lateral Buried Charge Accumulator and Sensing Transistor*, a technology unique to Nikon sensors. LBCAST is a relative of CMOS—the primary difference is that LBCAST uses a JFET type of transistor instead of MOSFET.

The CCD sensor used in the D80 appears to be a close relative of the sensor used in the original D1, believe it or not. Most people don't realize that the original D1 had almost the same number of individual photosites as the D80; the difference is that the D1 sensor grouped four photosites together (a process called "binning"), allowing it to get better noise properties.

Since the D1 sensor first was produced, Sony and Nikon have both gotten a great deal of experience with improving the basic technology and dealing with potential sensor issues at the ADC and in post processing. One primary change is the addition of a two channel transfer mechanism. We'll examine that when we examine the Bayer pattern a bit further along in this section.



The D80's sensor (the greenish area surronded by blue exposed here). This shot was taken with **Mirror Lockup** *so that the mirror mechanism flipped out of the way to reveal the sensor as it appears during the taking of a picture. The green area is the actual image sensing area.*

Any dust or dirt that gets into the mirror box (behind the lens) seems to ultimately work its way and attach itself to the sensor. Unlike some of the earlier Nikon bodies where the frame holding the sensor came right up to the imaging area, there's enough room in the D80 to get a Sensor Swab or SensorBrush off the imaging area when cleaning. The blue areas at the edges contain non-sensing electronics and signal paths, and act as a "landing zones" for brush and swab type sensor cleaning. See "Keeping the Sensor Clean" on page <538>.

Many newcomers to digital photography are confused by the published information about imaging sensors. Here are the key specifications for the D80 and other Nikon DSLR models:

Sensor Specifications (Size)

Camera	Size " (mm)	Pixel Size
D70/D70S	.93 x .61" (23.7 x 15.6mm)	7.8 microns
D100	.93 x .61" (23.7 x 15.6mm)	7.8 microns
D80/D200	**.93 x .62" (23.6 x 15.8mm)**	**6.05 microns**
D1X	.93 x .61" (23.7 x 15.6mm)	11.8 x 5.9 microns
D1H	.93 x .61" (23.7 x 15.6mm)	11.8 microns
D1	.93 x .61" (23.7 x 15.6mm)	11.8 microns
D2H/D2HS	.93 x .61" (23.7 x 15.6mm)	9.4 microns
D2X	.93 x .62" (23.7 x 15.7mm)	5.49 microns

Sensor Specifications (Pixels)

Camera	Active Pixels	Bit Depth
D70/D70S	3008 x 2000	12 bits (but compressed)
D100	3008 x 2000	12 bits
D80/D200	**3872 x 2592**	**12 bits**
D1X	4024 x 1324	12 bits
D1H	2012 x 1324	12 bits
D1	2012 x 1324	12 bits
D2H/D2HS	2464 x 1632	12 bits
D2X	4228 x 2848	12 bits[25]

Note: Nikon's pixel dimensions are always for the active imaging area of the chip. Moreover, Nikon has sometimes chosen a slightly different active area than the chip manufacturer suggests (3008 x 2000 instead of 3000 x 2000 for the D100, for example). But the active imaging area may be slightly less than the number of "effective pixels." You'll note, for example, that Nikon claims the D80 has 10.2 million effective pixels, but the image only ends up with about 10 (10.04 million to be more exact). That's because some of those extra pixels at the edges are masked off and used for noise management and other purposes.

Obviously, not all sensors are built the same, so what are the key differences, and what do they mean?

[25]Unlike some previous Nikon DSLRs, the D2xs, D200, and D80 do their JPEG processing with the full 12-bit capture prior to reducing to 8 bits. More on this in the section on JPEG (see page <124>).

First, note that the physical size of the D80's sensor is larger than that of the all-in-one consumer digital cameras, such as the Coolpix models, which use sensors much smaller (typically 4 x 5.4mm or 5.4 x 7.2mm, which is about one-ninth the area of a DSLR sensor in the best case). Likewise, the individual areas used to capture light and generate pixels—called *photosites* by engineers—are much, much larger than the Coolpix models (~36 square microns on the D80 compared to the best case Coolpix, the 5000, at 11.56 square microns). Note, however, that the D80's photosites are significantly smaller in area than those in the D50, D70/D70s, D100, and D1 series[26].

Size of the photosite is directly related to the ability to record a wide and accurate tonal range and inversely related to the amount of noise in the image data. That makes the D80's performance with its modest-sized photosites remarkable, as the light capture area is significantly smaller than that of many previous Nikon DSLRs. Yet the D80's sensor manages to eke out better performance in almost every area that can be measured. That just goes to show how fast technology has changed since the original D1 sensor design was completed in the late 1990's[27].

Sensor Filtration

The D80 uses a Bayer-pattern filter over the photosites, named for the Kodak engineer who originated the method.

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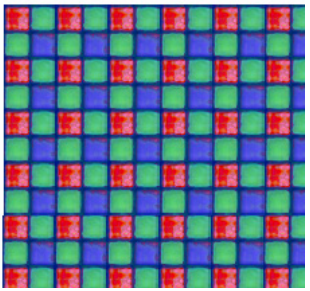
[26]The critical measurement is *area*. The best case in a Nikon DSLR, the D2hs, has a bit over 88 square microns of area in a photosite, while the worst case, the D2xs, has only about 30 square microns. Other aspects do come into play: somewhat less of the area of a CMOS sensor is devoted to light collection than on a CCD sensor, but overall, the area measurement gives you a ballpark way of comparing light collection ability.

[27]You might wonder if the pace will continue as quickly in the future. Perhaps, but other issues will start to make such advances less important. For example, the D80's sensor is good enough to clearly show the differences between poor and good lenses, and some designers think that the D80, D200, D2xs, and Canon 1DsMkII are nearing the resolution limits current lens designs can manage, especially in the corners. The D80, D200, and D2xs have a greater photosite density than the 1DsMkII, so we very well may soon need better lenses to handle any further advances. More likely, we'll get software that addresses physical lens defects if sensors continue to downsize (increasing the photosite per millimeter ratio).

Each individual photosite has a colored filter over it so that the underlying photosite is responsive to a particular range of color. Adjacent sites have different colored filters over them.

Basically, odd-numbered pixel rows alternate filters to produce red and green values, while even-numbered pixel rows alternate filters to produce green and blue. It's very important for D80 users to understand what this pattern does, and the consequences it produces in images.

The Bayer Pattern alternates colored filters over the individual photosites. Here's a close view of a small portion:



Many first-time digital users wonder why the green filter is used for twice as many photosites as the blue and red filters. One reason is that photosites, like our eyes, are most receptive to light wavelengths in the 500 to 600 nanometer range (i.e. green). Likewise, green light waves are in between the red and blue positions in the spectrum, and are found to some degree in most colors. Duplicating the green value gives the camera a better chance at discriminating between small differences in color and the amount of light (luminance) in a scene. (Photosites are least responsive to blue wavelengths [~400-500 nm], which produces other problems we'll discuss later.)

If you're saving images in NEF format (see "NEF format" on page <137>), the camera simply saves the values it recorded at each photosite into a file (along with some additional camera data). Software on your computer (Nikon Capture or one of the many third-party RAW file converters that are

available) is then used to interpret the photosite information to produce RGB values and a visible image.

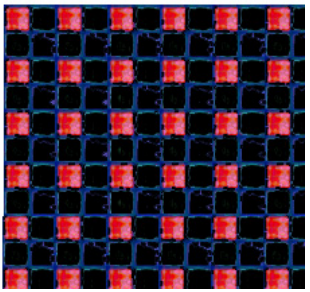
If you're saving images in JPEG format (see "JPEG" on page <124>), the camera must first process the photosite data into image data. It does this by a process called *interpolation*[28]. Interpolation looks at a block of photosite data and "guesses" the actual RGB values for any given photosite location (remember, at any given photosite, the camera only produces Red, Green, or Blue data, not all three; interpolation produces the missing two data elements). Interpolation has several serious consequences:

- *Green data are the most accurate*. Because the Bayer pattern repeats green, the camera has more data from which to make its guess. It also helps that the sensor is most sensitive to the green bandwidth. Moreover, subtle differences in green values actually make for larger perceived differences in colors, especially skin tones (yes, there's some green value in skin colors).
- *Red and Blue data generate the most "noise."* Since both the red and blue photosites aren't repeated in the Bayer pattern, there are fewer of those color data points from which to predict each pixel's value. Worse still, when the light hitting a red or blue photosite is low, noise becomes a significant possibility in the photosite's value (see "Noise," below). For example, you'll sometimes see noise in the red channel of a blue sky, or noise in the blue channel for a skin tone. Since the blue photosites are the least sensitive to light, indoor lighting can be a real problem for the sensor, as very little blue wavelength light is generally produced by incandescent lighting, and the lighting indoors tends to be dim to start with. Indeed, overall, the blue channel on the D80 tends to be the

[28]Technically, the actual name given to routines that convert Bayer pattern data into RGB pixel data is *demosaicing*. (The data is a *mosaic* of color information, and that mosaic must be reinterpreted into image data, thus the routine is called de-mosaic-ing.) *Interpolation* is a more general name given to any conversion that involves creating new data from partial or smaller datasets.

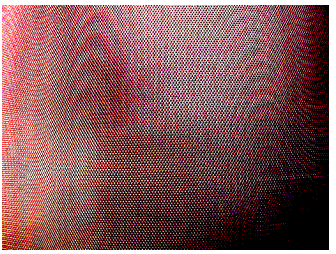
noisiest (at least until the camera's noise reduction circuitry comes into play), and this problem is compounded in incandescent light because there is so little energy in the blue wavelengths available to be captured by the sensor.

- *Red to Black and Blue to Black transitions compromise detail*. Black is defined as the absence of light in all three channels (R, G, and B). Thus, when you have a pure red area adjacent to a pure black area, the Bayer pattern gets in the way (no value is being reported by the G and B photosites, thus only one in four photosites is providing useful information that can be translated into image detail). Red to Blue transitions can also exhibit a similar problem, though usually not as visually intrusive as the Red to Black or Blue to Black ones.



Shooting a scene with only red and black renders three quarters of the photosites inactive, as only the red photosites are providing measurable light values. Compare this matrix to the previous one and you'll see that the effective resolution has decreased (I've made the patterns the same size).

- *Moiré patterns may appear*. When the frequency of image detail changes at or near the pitch of the photosites (imagine a photo of the screen on a door where the line intersections of the screen hit almost, but not exactly on the photosites), an artifact of interpolation is often a colored pattern called moiré.



Moiré shows up as added "detail" not in the original, usually with a color pattern to it. In this example I've exaggerated the contrast and color so that you can see wavy patterns that weren't in the screen being photographed (the original screen is silver with a tight diagonal weave in a regular pattern—those curvy lines and color changes don't appear in the screen's pattern). You get moiré most often from things like screen doors, tightly woven fabrics, and any other object that has a small, repeating, regular pattern of detail.

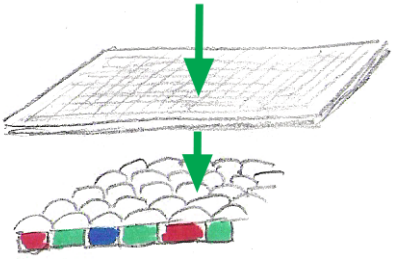
Before we leave the sensor filtration topic, we need to discuss how information gets off the sensor, since it is color specific.

On top of the D80's sensor sits a "low-pass" filter, sometimes called an anti-aliasing (or AA) filter[29]. The low-pass portion of the filter is used to prevent (as much as is possible[30]) color aliasing artifacts (like moiré). However, the low pass filter used on the D80 isn't an overly aggressive one—D80 images show more aliasing as a proportion of resolution than does the D70s, for instance. The D1 series and D100 had relatively high anti-aliasing applied compared to the D70s and D2hs. The D80, D200, and D2xs are somewhere in between.

If you're getting the idea that the D80 sensor is a "sandwich" of things, you're correct. Here's a run-down of the things light has to go through to get to the actual "light-sensing" area on the sensor:

[29]Nikon's penchant for jargoning-up the terminology and then abbreviating it leads them to call it an OLPF (optical low pass filter) in some of their literature.
[30]From a designer's viewpoint, the engineers must balance the intensity of the anti-aliasing filter with the destruction of resolution. The stronger the anti-aliasing effect, the more the acuity of small detail suffers. Likewise, the less strong the anti-aliasing effect, the easier it is to trigger unwanted moiré. Personally, I'd rather have the additional detail and deal with the moiré than vice versa, but some users hate moiré because it requires post-processing skills to remove.

- Infrared removal filter ("IR cut")
- Low-pass filter (anti-aliasing)
- Microlenses
- Bayer-pattern filter



The antialiasing filter (top plane) filters out high frequency detail and near infrared energy in the light (green arrows) before it gets to the microlenses that sit over the photosites (below). The antialiasing filter also incorporates IR filtering.

Note: *Nikon has indicated that they've "combined" a number of properties in the filtration above the sensor in the D80. For example, the IR-cut filtration necessary for digital work is integrated into the anti-aliasing layer on the D80. Indeed, instead of thinking of the functions shown above as separate filters, it might be more appropriate to consider them as separate technologies in a single "sandwich" of things. In optical designs, you want to minimize the number of air-to-surface transitions, and that would be true of the items over the sensor as well as the design within a lens.*

Note: *Why is the filter called a "low-pass" filter? Artifacts—unwanted data—are produced by any analog-to-digital conversion. There's a basic rule of conversion that all input frequencies below something called the Nyquist frequency will be correctly produced, while those above the frequency tend to more easily generate aliasing artifacts (often visible as moiré or color fringing in digital cameras). The filter on the D80's sensor attempts to pass the data below the Nyquist frequency for the sensor pitch, and reject data above that frequency, thus the name "low-pass."*

Tonal Range

12 bits-per-pixel tonal range may not seem like much, but it translates into the ability to render 4096 shades (using 12 bits) of an individual color versus 256 (using 8 bits). While the capability of most human eyes is close to what an 8-bit capture contains (our eyes are usually said to distinguish about 16 million colors, which is approximately what 8-bit RGB produces; 256 x 256 x 256 = 16,777,216), the extra tonality of 12 bit captures is still useful. When we "sharpen" and apply other corrections to an image in post-processing, it is usually easier to keep such manipulations from becoming visible with the extra bits (i.e. we can "hide" some of our manipulation in the extra tonality, and rounding errors have less visible consequences).

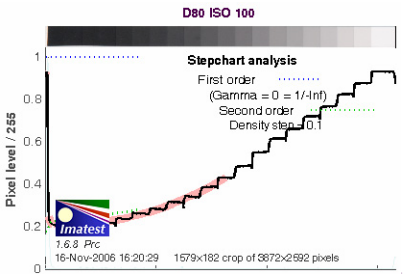
Here's a tonal ramp rendered two ways. On the top, it's rendered as a continuous spectrum from black to white. On the bottom, I've arbitrarily separated it into 19 different tones (slightly better than a 4-bit value can contain). The more tones we use to go from black to white, the more subtle transitions like this look. This is one reason why pros prefer to use raw files, which have 12-bit values, instead of JPEG, which have compressed 8-bit values.

Better still, the D80 captures dark to bright in a somewhat more predictable fashion[31]; 35mm film tends to have a widely varying response (density of image) to exposure, producing a distinct S-curve when you plot exposure against density. Worse still, most film has a property called reciprocity failure—the tendency to require a different exposure at extremely short or extremely long shutter speeds. The bottom line on digital tonality is that the shadow areas are less likely

[31]"Predictable" isn't quite the right word to use, as no imaging device I know of has a perfectly predictable response to light. My point is that a D80's tonality curve is more regular than film's, which tends to vary more with brightness and exposure length.

to "block up[32]" in underexposure, as does most slide film, for example.

One thing that is a bit unexpected about the D80's tonal range is that it isn't perfectly flat, as it has been on most previous Nikon DSLRs. By "flat" I mean that the rendering of the white-to-black patches on a Kodak stepped grayscale chart don't result in the expected flat line (see chart, below).



There's a slight but significant "dip" across the range of the tonal curve (at least at the camera's **Normal** Tone Compensation setting), with changes in slope at both the deep shadow (left) and bright highlight (right) ends. The overall impact of this is a bit more mid-range contrast than previous Nikon bodies, and a little less of the "Nikon drab" look some have complained about in out-of-camera JPEG images.

Note: Some of the test charts presented in this eBook and on my Web site are pieces of the elaborate testing results that the Imatest testing software produces. Imatest is also the software I use to verify the things I see in D80 images. While I don't always present the test results in this eBook (you've got enough pages and examples to wade through as it is),

[32]Imagine a chart with 64 increasingly brighter shades of gray from black to white. If you were to photograph that chart, a "blocked up" shadow area would be one that did not reproduce differences between adjacent dark grays, essentially rendering many of them black (or near-black). Because film has a non-linear response to light, many different light values are sometimes produced as black. Fuji Velvia, a slide film favored by many professionals, has a pronounced tendency to render *any* object underexposed by more than three stops as a rich, velvety black. The same problem can occur at the bright extreme, as well. Blocked up highlights would be all bright objects rendered as the same white (or near-white) color.

almost all of my statements about image quality properties have been empirically tested by both careful image shooting and running standard test charts through Imatest.

Imatest is probably the most precise testing facility easily available to the average user. I highly recommend it as a way to get to know the nuances of your camera's response. One small thing, though: you'll need a number of test charts to take full advantage of the program, and some of these charts are expensive because they're produced to exacting standards. See http://www.imatest.com for more details. And don't forget to tell Norman that I sent you.

Brightness v. Darkness

For any photographic situation we find ourselves in, there is always a range of brightness, from dark to light. In our offices we try to keep the range minimized—in other words, there's usually not a big difference between the darkest areas and the brightest. But in the real, uncontrolled world, the range from dark (densely shaded area) to bright (sun bouncing off a metallic object) can be considerable. We call the brightness differences we encounter the *exposure range*. We refer to the ability of our film or digital camera to capture a range of brightness the *dynamic range*[33].

We measure both ranges in terms of *stops*; each stop represents a doubling of light. So if I were to say that a scene I wanted to photograph had four stops of exposure range in it that would indicate that the brightest areas are 16 times lighter than the darkest. Unfortunately, many outdoor scenes can have 10 or more stops of exposure range in them. That's a huge range of light.

Overall, the D80 has slightly less dynamic range than is captured by most print films, but slightly more dynamic range

[33]Dynamic range is commonly used as the term for both things. You'll often hear someone say "the dynamic range of the scene is eight stops and our camera can only capture six stops of dynamic range." I've elected to keep the two terms separate here so that you'll know if I'm talking about the scene (exposure range) or the device (dynamic range).

than most slide films can handle. What's that mean in numbers? My measurement system says the D80 maxes out somewhere around seven stops of dynamic range (some others measure a bit differently and come up with a slightly different number). Using the same system for the slide film I use (Provia F), I get about six stops of dynamic range. With the negative film I use (Portia) I usually measure eight or nine stops (processing and printing can have an impact).

The dynamic range of the D80 is fixed, but the scenes you'll encounter and wish to photograph aren't fixed in their exposure range. Sometimes you'll find scenes that have very little exposure range (said to be low in contrast), sometimes you'll encounter situations that have extreme variations in exposure range (said to be high contrast).

In terms of our sensor and the buckets it collects light in (photosites), dynamic range is restricted at both ends by different things. At the bright end, as I've alluded to before, the bucket has a limit to what it can hold. Once the bucket is full, it doesn't matter how many more light photons strike it, they won't be collected, and thus not measured.

At the other extreme, we have the inability to measure small amounts of light. Imagine it this way: let's say you just washed your bucket and gave it a quick wipe to dry it. Now one drop of rain hits the bottom of the bucket. Can you measure how much rain has fallen? Well, no. There's residual moisture in the bucket from the cleaning, and we haven't collected enough new water to distinguish that from the residual moisture. Likewise, with sensors: there are residual electrons in the photosite and we need to convert enough light photons into electrons so that we can differentiate the two.

With a DSLR, *you* are in charge of getting the exposure "right." That means that you have to consider what the D80 can capture (dynamic range) versus what you're trying to photograph (exposure range). I'll have much more to say about exposure as we proceed to learn about the camera (see "Metering and Exposure" on page <215>, for example). But

suffice it to say that the CCD in the D80 has a fixed dynamic range it can capture while the situations you want to photograph will present quite a variety of exposure ranges you'll need to deal with. Don't fret—the D80 has a plethora of automated features to help you. But you'll want to pay close attention to exposure, and knowing what the sensor can capture is part of getting exposure "right."

Fortunately, your D80 doesn't have one exposure problem that plagues film: reciprocity failure, or the tendency to require a different-than-expected exposure at extremely short or extremely long shutter speeds. If you can measure the light in a scene, the D80 can be set for that directly, with no compensations for short or long shutter speeds.

Spectral Characteristics

The spectral characteristics of the D80 sensor are currently unavailable. Unlike the D2hs, the D80 does not seem to have a near-infrared pollution problem, which required using a hot mirror filter on the D2hs to correct.

Indeed, the D80 seems to have reduced reactions to *all* light outside the visible spectrum. Both UV and near-infrared response is considerably lower on the D80 than any previous Nikon DSLR I've tested other than the D200 (see "Infrared" on page <533>). This will have an impact on some purple values, which live down in the high UV spectrum. Finally, like many digital cameras, the blue spectrum seems to be the D80's weakest; the green and red responses seem to be stronger and less prone to error.

Noise

Noise refers to pixel data values in your image that are different from what a "perfect sensor" would produce.

For example, in a "perfect sensor" three adjacent pixels from an evenly exposed gray card might be rendered with RGB values of 110,110,110. Most digital sensors aren't that perfect (and there's rounding going on somewhere to get to an 8-bit value for JPEG images, which slightly exaggerates noise), so

you might have one pixel that's 110,109,110, another that's 110,110,111, and a third that's 110,110,110. As noise increases, the divergence of those values would increase. For example, if the proper value is 110,110,110, then a value of 102,114,107 is clearly "noisier" (and less accurate) than one of 108,112,108.

Here's a 100% view of a section (592 x 686 pixels) of a D80 NEF image taken at the **H1.0** *ISO value (ISO 3200) and intentionally underexposed to present a worst case situation (we'll look at this image again when I discuss ISO later in the eBook). Note the rough, grainy texture throughout, easily visible on the orange rim. Plenty of false values are showing up here. The overall impact is more like that of a rough film grain.*

Immediately below the original is a sample I've done noise reduction on using Neat Image. Note how the rough texture has now disappeared (at the expense of very fine detail).

Sensors tend to produce more noise when left exposed to light for long periods of time, when exposed to low levels of light, when exposed to low levels of red or blue wavelengths of light, or when used in *very* warm environments. Setting higher ISO values generates more noise because you're amplifying the underlying values, and so small disparities become more visible as you increase the amplification.

Noise shows up in photos as incorrect pixel values, and is easiest to see in large areas of a single color (like the sky, or the rim in the above image) or in deep shadow areas (where noise shows up as false detail).

As I noted earlier, the larger the photosite, the less that noise is a factor. Thus, Coolpix users have discovered that pictures they've taken on very warm nights (>86°F [30°C]) often exhibit large amounts of incorrect or random pixel information, while D80 users don't typically see this problem until the temperatures get extreme (if you're uncomfortable, the D80 will be producing more noise than normal).

Different types of noise exist, and the D80's ability to deal with each of the various types ranges from decent to excellent.

"Dark current" is the name for a form of thermally-induced current that the photosites produce even when they aren't struck by light[34] (thus the "dark" in the name). Each individual sensor tends to have a different dark current noise pattern, much like humans have unique fingerprints. That pattern will change a bit over time, and with temperature. Nikon, like all digital camera makers, masks off from light some photosites at the edges of the sensor so they can determine what the sensor thinks is absolute black (read: the average dark current), but this system isn't foolproof[35].

With **Long exp. NR** turned **On**, the D80 creates an exact "map" of the dark current in the sensor by taking a second "blank" exposure at slow shutter speeds (longer than 8 seconds), allowing the camera to further reduce noise by subtracting the exact dark current map from the image data. Dark current noise handling on a D80 is actually relatively

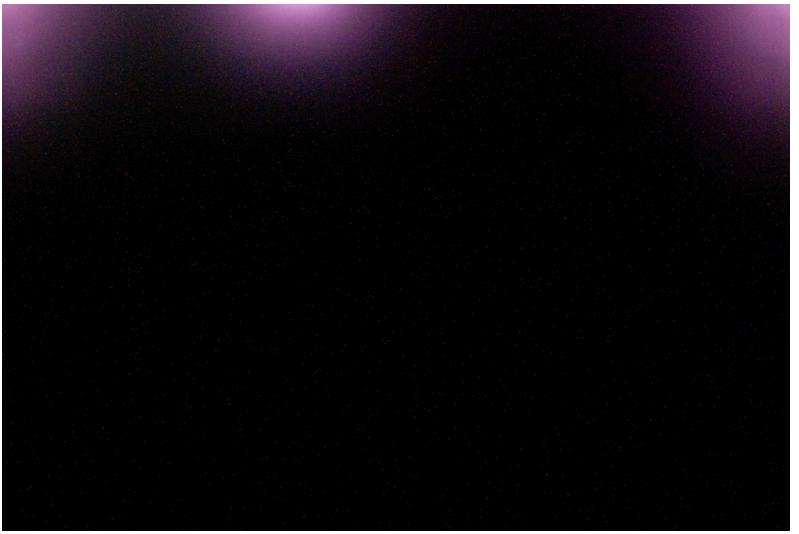
[34]Actually, struck by photons.

[35]You may have noted that Nikon claims the sensor is 10.2 effective megapixels, but the actual recorded image only has 10mp. Masking is part of the answer. The actual number of photosites on the sensor is 3948 x 2768, but some of those extra photosites are used for the dark current mask and black level detection.

poor without this function being turned on (for reasons we'll get to in a moment; but first we need to deal with one other type of noise).

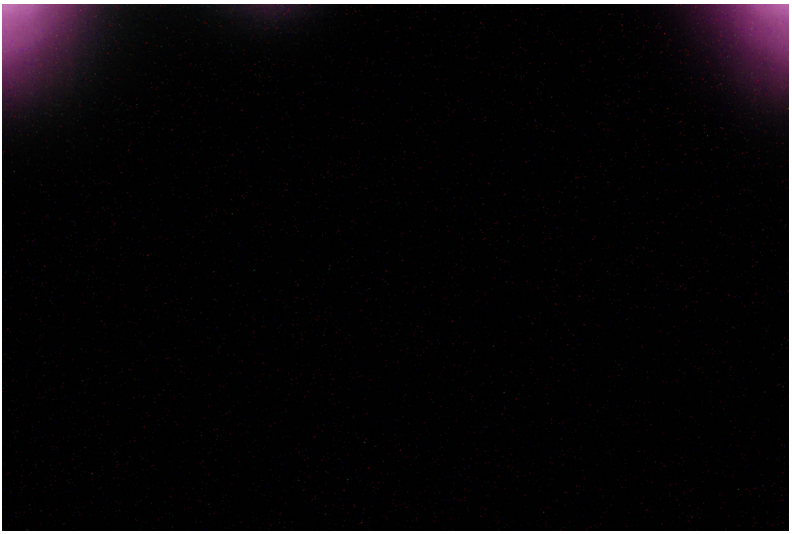
The second type of noise we generally deal with, and which the D80 has in modest quantity, is noise due to signal amplification, or noise caused by small variances in values that get distorted as we use amplifiers to get higher ISO values. The D80 is decent at handling this type of noise, as we'll see in the section on ISO sensitivity later in this eBook. The basketball example image shown a couple of pages back is relatively high in amplification noise, though this noise is distributed relatively randomly and doesn't have the usual "digital look" due to color (chroma) variations.

A third type of noise is called "amp noise" (not to be confused with noise *due* to amplification). This refers to thermally-induced noise generated by other electronics or heat sources near or adjacent to the sensor. Such noise is so low in value that you won't see it unless you shoot extremely long exposures. For example, here's a 15-minute exposure taken with my initial D80 at ISO 1600 and the lens cap on (the entire image should therefore be black):



The purple that shows up in the two top corners and middle top left is telltale amp noise, caused by heat and escaped electrons from electronic components near the sensor. Indeed, if I touch the back of my initial D80 on a really long exposure, I can often *feel* the heat buildup, it's that significant.

But here's the same thing from a D80 with a serial number higher than 3050000 (in the US):

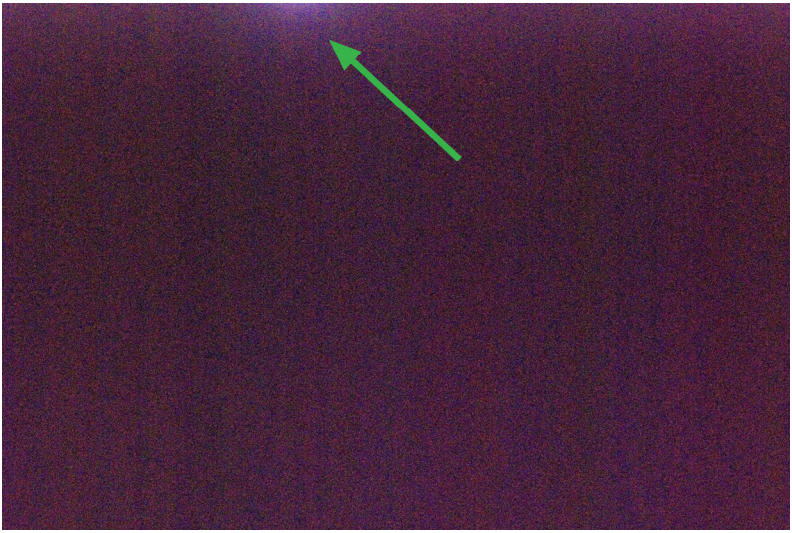


Note that the middle point of amp noise is now mostly missing. Nikon changed something in later batches of D80 cameras they made, which improved the amp noise characteristics. Neither the early nor later production is perfect, however; overall, the D80 is not great at handling amp noise, regardless of the version you have.

In normal conditions at most ISO values, you won't find any amp noise in your shots. It usually takes exposures measured in minutes before it'll show up, and if you're using exposures that long, you should have **Long exp. NR** turned **On**. Using that setting usually removes most, but not all, of the amp noise, and reduces any hot pixels, as well.

However, those early D80 bodies appear to have a limitation that none of the other Nikon DSLRs have, nor do the >3050000 US D80 serial numbers show: amp noise can show up under normal shooting! Here's an exposure at 1/5 second and ISO 1600:

Looks okay, doesn't it? Look again. Let me help you by processing the file dramatically so that you can see what's happening deep down in the blacks (I've added a green arrow to point to the area I want you to pay particular attention to):



That purple glow is once again amp noise (you can safely ignore the rest of the noise in this example, as I've boosted levels so high that you'll see other things that won't impact your image quality).

If you look carefully at your ISO 1600 shots taken at very slow shutter speeds, you may see that this area in the frame tends to be slightly noisier and, in the worst examples, sometimes has a slight color cast. No other Nikon DSLR has this problem except at exposure settings I would call extreme, and only early D80 bodies seem to exhibit this problem. The only way to absolutely avoid it is to use faster shutter speeds (typically 1/60 or faster) at high ISO values. For most D80 shooters, that's not going to be an issue, as you can't really handhold the camera at slower shutter speeds with normal subjects without having bigger problems (camera or subject movement). But be aware that as you boost ISO and lower shutter speed simultaneously, the D80 is prone to producing more noise in that top central area of the frame.

Don't panic. Amp noise is a *limitation* of your D80, not a fault. At ISO values below 1600 you shouldn't worry about it for any exposure you can set normally. At ISO 1600 and above, if you have a very early body, you should be aware

that long shutter speeds *may* produce some noise in that top central area I indicated earlier. To avoid seeing it, be sure you don't underexpose!

Finally, while not technically "noise," photosite size also intersects a bit with lens quality. Many consumer cameras using smaller sensors can produce very visible chromatic aberration[36]. On digital sensors with enough resolution any lens focus aberration can fall onto an individual photosite and dominate the color information for that area (as you've already learned, each photosite only records a single color, so such dominance is not good). (It's also true that it is difficult to build short focal length lenses in consumer quantities with low aberration properties.)

The smallish photosites of the D80 (compared to the D1 series and D2hs) have the side effect of making it easier to resolve chromatic aberration and other lens issues. It is far easier to tell "good" lenses from bad on a D80 than it is on a D2hs, for example.

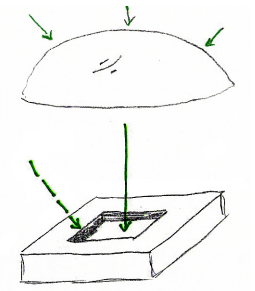
Sensors and Light Alignment

Nikon also touts the fact that light is "telecentrically" corrected for each individual photosite. Camera lenses "bend" light to focus on the film plane. This can be a problem even with film, as film usually consists of several "layers" of light sensitive material, and light hitting at an angle is recorded at a slightly different position in each layer. In extreme cases—especially if the lens has any chromatic aberration that focuses colors at different points—this results in a loss of color saturation, or in color fringing on detailed objects.

To prevent this being a problem in the D80, a small lens-like bit on top of each photosite—called a microlens—redirects the light so that it enters the sensor perpendicular to the film plane. The result is better color accuracy and saturation, and

[36]Chromatic aberration refers to the extent that a lens doesn't focus all colors at the same point.

less light fall-off in the corners (compared to a photosite without microlenses).



We don't want light hitting the photosite from oblique angles (dotted green line in above illustration), because it might not get into the photosite's light collection well. So the microlens is designed to take light hitting at all angles and redirect it straight down into the photosite well.

The smaller sensor size also comes into play here. Getting light from the rear element of a wide angle lens to the far corners of the full 35mm frame means that light can hit the extreme corners of the frame at a very oblique angle with older lens designs. As previously noted, we want light to hit the sensor as close to perpendicular as possible. Nikon has done three things to make this true for their DSLRs:

- *APS frame size*—The smaller frame size of the Nikon DSLRs mean light doesn't have to get "bent" as much to reach the edges of the capture area.
- *Microlenses*—These small lens-like additions to the filter pack capture light hitting the sensor from angles and reorient it more towards perpendicular.
- *New lens designs*—Starting as far back as the 17-35mm f/2.8D Nikkor, Nikon appears to have begun designing wide angle lenses with a modified rear element design. Essentially, all Nikkor wide angle lenses are now designed with rear elements that don't try to make a final dramatic "bend" in the optical path.

The net result of Nikon's attentions is that the D80 avoids some of the bigger pitfalls that can befall high resolution digital devices. Note that chromatic aberration and light falloff, the two primary visible culprits we're trying to avoid, can and do show up in D80 images. It's just that Nikon has managed to minimize their presence.

Sensor Longevity

Another question about sensors that gets asked a lot is "how long will this sensor (and thus digital camera) last?" From the reliability and mechanical standpoint, the answer is as long as a film camera. But the Bayer and IR filtration does come into play here. Since the filtration itself is usually created using dyes, and dyes tend to fade with long-term exposure to light, I suspect that this is going to be the weak link in sensor longevity.

The good news is that, even if you take tens of thousands of shots, the sensor is being subjected to light for only fractions of a second at a time. In short, the overall light accumulation for even a heavily used D80 is going to be minimal, and your shutter is likely to give up the ghost long before you've let in enough light to start impacting the dyes in the Bayer filtration.

Consumer cameras such as the Coolpix expose their sensors (and thus filters) to light almost constantly, and we've yet to see any significant fading problems with units that are as much as a decade old. Thus, I don't expect filter fading to be an issue at all with a D80, even after years of use. Still, I've added a new caveat to my cleaning instructions later in this book and on my Web site: clean quickly and not in the presence of high-powered light sources.

Sensor Wrap-up

One final reminder about photosites: their light-catching regions don't fill the entire area the sensor array occupies. This catches some digital newcomers by surprise, as they imagine that the photosites are all jammed up against one another and the entire sensor captures light. The photosites *are* jammed together, but the light-sensing portions of most

sensors, including those in the D80, are smaller than the overall photosite size, partly in order to keep light photons from migrating too easily to adjacent photosites, partly to allow room for other signals on the chip (power and data transfer, primarily).

I've also sidestepped one issue in this discussion of how a sensor works: how the amount of light (an analog value) becomes digital data. To make a very complicated story short, the light photons captured by the individual photosites are converted into electrons at each photosite. These electrons are moved at the end of the exposure to two Analog-to-Digital converters (ADC). These converters have a relatively simple job, which is to evaluate the number of electrons they see at each photosite and convert that into 12-bit digital values that are then passed on to the rest of the camera's circuitry.

Another wrinkle enters into play here, as well: Nikon is adjusting for white balance while the signal is still in the analog domain (i.e., before the ADC does the conversion to digital). Nikon calls this "color preconditioning." More on that in the section on White Balance (see page <272>).

Tip: *For a fuller discussion of how sensors work, see* *http://www.bythom.com/ccds.htm*.

Power

The D80 uses two batteries, only one of which is user-accessible. The main battery is a 7.4V, 1500mAh[37] Lithium-Ion EN-EL3e pack, same as the one used in the D200. This battery is similar to but *not* the same as the EN-EL3 or EN-EL3a used in the D50, D70, D70s, and D100. Each EN-EL3e battery weighs about 2.6 ounces (75g), which makes carrying multiple batteries painless.

[37]What's mAh mean? That stands for milliamp hour. In other words, the battery could provide a constant 1500 milliamps of current for an hour. Since the camera at idle draws less than 3mA, which would mean that the camera could be left on for over 20 days before the battery would go dead. Of course, once you start taking pictures and using the many powered features of the camera, that number drops considerably.

The differences between the EN-EL3e and the previous EN-EL3 and EN-EL3a are:

1. The EN-EL3e stores more mAh than the original EN-EL3 (1500mAh versus 1300mAh; the EN-EL3a was also 1500mAh).

2. The EN-EL3e has a third connection terminal that the camera uses to monitor the battery condition.

It's this third connection that makes it impossible to use older EN-EL3 and EN-EL3a batteries in the D80: the camera will not operate at all if it can't get information about the status of the battery, which comes via that third terminal. However, note that the D80's EN-EL3e battery works just fine in a D50, D70, D70s, D100, or D200. In other words, if you have any of those other cameras, you can simply standardize on the battery that came with the D80.

To keep the confusion to a minimum, EN-EL3e batteries—the ones that work in a D80—are gray instead of the black color of the earlier, incompatible batteries. Bottom line: gray Nikon batteries work only in the D80 and D200, gray *or* black Nikon batteries work in the D50, D70, D70s, and D100.

Note: Like all EN-EL3 type batteries, the terminals are exposed, so the risk of shorts that can cause battery damage, explosion, or generate heat that could start a fire are a small issue while carrying batteries without the protective cover. Keep the protective cover on the battery when it is outside the camera or charger, if possible.

In the United States, the battery and MH-18a Quick Charger are supplied with the camera; in other parts of the world, the battery and charger may need to be purchased separately. In any case, you're most likely going to want a spare EN-EL3e.

The charger is light (3.6 ounces, or 100g) and modestly sized. The battery "docks" in the charger by sliding it into the charging position (don't worry, you can't do it wrong). The AC power cable is removable.

The design of the EN-EL3e battery makes it impossible to insert it incorrectly into the D80's battery compartment, so never force it. The same is true of putting the EN-EL3e into the charger. The MH-18a Quick Charger can fully charge a *fully depleted* EN-EL3e battery in a little over two hours. The MH-18a is fully compatible with 120 or 240 volt, and 50 or 60Hz outlets.

Another point of confusion for D80 purchasers coming from older consumer Nikon DSLRs will be the MH-18 versus MH-18a charger. It shouldn't be. Technically, the MH-18a is the charger designed to work with the 1500mAh batteries (EN-EL3a and EN-EL3e) while the MH-18 is designed to work with the older 1300mAh batteries (EN-EL3). But either will charge a D80 battery. The only real difference between them is that the older MH-18 is a little bit bigger than the MH-18a supplied with the D80 and D200. For those of us who travel a lot, that was a welcome change.

The fact that the charger only has two connection terminals while the battery has three also confuses some users. The charger just charges the battery—more sophisticated battery systems sometimes use extra connections to tune or balance cells within the battery, which the MH-18a doesn't do—so the MH-18a only needs the two power connections. That

third connection on the battery is *only* used by the camera, and it specifically is used to report the status of the internal power cells in the battery.

Note: Unlike the NiMH batteries used for the D1 series, the Lithium-Ion EN-EL3e used with the D80 shouldn't have to be "conditioned" prior to use.

Still, it has been observed by many that new EN-EL3e's seem to improve slightly with use, which means that they may have some storage effects that need to be rectified.

I would suggest, therefore, that you fully exhaust the battery (<10% charge remaining) the first two or three times you use it and make those first charges thorough ones, waiting until the battery cools before removing it from the charger (i.e. don't pop it off the minute the light stops blinking; let it continue to trickle charge for another hour or so). This should be enough to offset any storage effects and put the battery in full operating condition.

Changing Batteries

The EN-EL3e battery is inserted into the camera as follows:

1. On the bottom of the camera, push the small indented button on the Battery Compartment door towards the center of the camera (towards the PacMan-like symbol; green arrow in photo). The door should pop open.

2. Slide the EN-EL3e into the camera.

3. Once the battery is fully inserted, push the door closed. You should hear the door retainer click into place.

To remove the battery:

1. On the bottom of the camera, push the small indented button on the Battery Compartment door towards the center of the camera (towards the PacMan-like symbol). The door should pop open.
2. Hold the camera so that the battery slides out of the camera. Don't worry, it won't fall to the floor; there's a retainer on the side of the battery compartment that only allows the battery to stick 3/8" (1cm) out of the camera.
3. Firmly grasp the edges of the battery and pull it from the camera. You'll feel a bit of resistance at first, but the retainer should let go of the battery if you tug firmly.

Note: The camera power switch should be in the **OFF** *position before removing (or inserting) an EN-EL3e battery pack.*

Charging Batteries

To charge the EN-EL3e:

1. Remove the battery from the camera.
2. Plug the MH-18a charger into a wall socket.
3. Slide the EN-EL3e battery into the cut-out on the top of the MH-18a. The status lamp on the MH-18a should begin blinking, indicating that the battery is charging.

Note: The legend next to the light on the charger confuses some people. If the charge light is blinking (✷), the battery is charging. If the charge light is in a steady on state (●), the battery is fully charged.

Note: You do not have to completely discharge the EN-EL3e before charging it. Lithium-Ion batteries do not exhibit the "memory" effects that NiCad batteries did, and thus can be "topped off" at almost any time without consequences. That said, generally you're better off not charging the battery if the level is at 90% or higher, as doing so repeatedly can reduce the overall capacity slightly. Likewise, you're best off if you don't run the battery down to <5% all the time, as repeated deep charges tend to reduce the life expectancy of the battery slightly. Neither is of enough concern to worry about, but if you're trying to fully optimize your battery life, only charge it when it's between 20 and 80 percent capacity if you can.

The battery charger can't be used to power the camera, as is the case with some other cameras. This is a serious design flaw, in my estimation, adding extra cords and gadgets a D80 photographer shouldn't need to deal with. (It doesn't help matters that D1 series models used different chargers and batteries than the D50/D70/D100/D80/D200, which in turn use different chargers and batteries than the D2hs/D2xs. This proliferation of battery/charger/AC adapters is a very frustrating aspect of using Nikon DSLRs while traveling.)

Battery Storage

If you're not going to use an EN-EL3e for a long period of time (several weeks or more), you should make sure that the battery is neither fully charged nor almost empty. In the case of the former (fully charged), storing it for a long period may

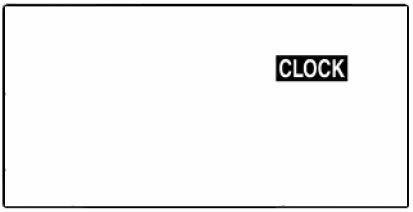
cause it to lose some of its capacity (a couple of deep charges—from <5% capacity to full—on the charger might restore that, but not always). In the case of the latter (empty), the battery could discharge too deeply and be damaged by that.

Thus, always store the EN-EL3e battery with a mid-range amount of charge left in it (optimally, it should be at 50% charge).

Clock Battery

The D80 also has a small, *internal* battery for keeping the date and time. This battery has an expected charge life of about three months. Keeping the camera powered for two days (either with an EN-EL3e battery in it or by connecting the camera to the AC Adapter) should fully recharge the internal clock battery.

When this battery depletes, a CLOCK symbol appears on the top LCD and image files no longer have a date and time stamp:

Top LCD: 

To recharge the clock battery, simply make sure that the camera has a fully charged EN-EL3e in it for two days.

Note that charging the clock battery is probably one of the reasons why some D80 users report that their battery life improved after the first uses of the camera. Once the clock battery is fully charged, it needs only trickle charge energy from the EN-EL3e to keep it healthy.

Alternate Power Sources

As an alternative source of main camera power, you can use the EH-5 AC Adapter, which plugs directly into the **DC In**

socket on the left side of the camera. The AC Adapter provides the camera with 9 volts at 4500mAh (i.e. any third party battery or adapter that would connect to the **DC In** socket would have to supply the same voltage[38]).

Here's the weird thing: the D200 uses the same battery technology (EN-EL3 series) as the D50/D70/D100, but uses the same AC technology (EH-6) as the D2 series, while the D80 uses the same battery technology *and* the same AC technology (EH-5) as the D50/D70/D100.

It's an important detail for those of us who travel with and own multiple Nikon cameras. Someone transitioning from a D50, D70 series, or D100 body won't have to buy a new AC adapter for their D80, but someone who uses a D200 or D2 model will. This has an impact on someone who purchases a lesser specified body as a backup to a higher specified one. For example, a D200 user might at first consider a D80 as a potential backup body until they find out that the D80 takes different storage cards and uses a different AC adapter.

Note: Note that when running the D80 from the EH-5 without a charged battery in the camera, if you accidentally "pull the plug" during shooting, any images in the internal buffer are lost, and the Secure Digital card may be corrupted due to an incomplete write cycle. I generally recommend that you always have a battery in the camera when using the AC adapter.

Note: The camera power switch should be in the **Off** *position before removing or inserting* ***any*** *connection to the* **DC In** *slot. Nikon warns that the internal circuitry can be damaged if you unplug the EH-5 while the camera's power switch is*

[38]You'd also need to find the right connector which, unfortunately, is yet another Nikon-proprietary one. Here's the trick to get around that: buy the EH-5. Cut the cable from the EH-5 to the camera in half. Wire the cut cable ends with a standard male/female connector set of your choice, and then use the same set on your external battery supply. You must be *very careful* to keep the voltages and polarities on pins correct. Failure to get these correct could fry the electronics of your camera, making it inoperable. Please read the legal disclaimer on the Copyright page before attempting to make your own external power supply.

in the **On** *position, so this may be true of external batteries, as well.*

The D80 can also be powered by a variety of batteries in the optional MB-D80.

The optional MB-D80 comes with a tray (lower right) that allows you to use six AA batteries to power the camera. Alternatively, you can use one or two EN-EL3e batteries (lower left).

The MB-D80 can hold two EN-EL3e batteries or six AA batteries (which can be alkaline, NiMH, or lithium).

To use the MB-D80:

1. Mount the MB-D80 to the D80 body.
    a. Remove the Battery Compartment door on the D80. Open the door to about a 60 degree position from the body and pull on it with a steady force (green arrow). It should easily

snap out of its restraints. Do not force!

b. Remove the cap covering the contacts on the MB-D80 and place the Battery Compartment door in the slot on the part of the MB-D80 that sticks into the battery chamber (green arrow in photo). This ensures you don't misplace the door while the MB-D80 is on the camera.

c. Remove the EN-EL3e battery.

d. Slide the contact end of the MB-D80 into the D80 battery compartment. As you do this, make sure that the tripod socket and outer

alignment tab on the MB-D80 are going into the D80 correctly. Do not *twist* the MB-D80 in relation to the camera.

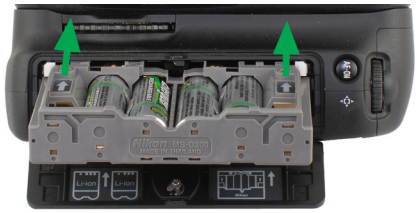
e. Use the large, knurled knob on the MB-D80 to secure the MB-D80 onto the camera.

2. Open the MB-D80's battery compartment by lifting up the Battery Door Latch handle and then turning it counter clockwise.

3. Remove the AA battery tray by pushing the two white plastic Battery Tray restrainers apart and pulling out

the tray.

4. If you wish to use AA batteries in the MB-D80:
    a. Place six AA batteries into the tray in the orientation etched at each tray position (four batteries insert into on one side, two on the other side of the tray).
    b. Push the battery tray back into the MB-D80. Note carefully the white orientation arrows on the top of the battery tray; these point to the side of the tray that goes into the MB-D80 first (and they should be facing up where you can see them).



    c. Set CSM #32 (see page <442>) to the type of AA batteries you're using. (I recommend using NiMH rechargeable batteries of at least 2000mAh.)
5. If you wish to use one or two EN-EL3e batteries in the MB-D80.
    a. With the AA battery tray removed, push a battery into either the left or right position in the MB-D80. The proper battery orientation is the curved side down with the connectors up

on the side that goes into the camera first.

b. If you wish to use two batteries (recommended if you have two), put the other into the second position, same orientation. You don't need to make any custom settings to tell the camera that you're using one or two EN-EL3e batteries.

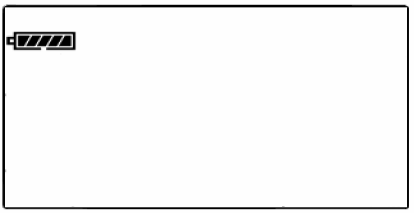
6. Close the battery compartment door on the MB-D80, turn the Battery Door Latch handle clockwise, then fold the Battery Door Latch handle back against the MB-D80.

Note: If both batteries are fully charged, then the left-hand EN-EL3e battery (as you look at them with the door open from the back) is used by the camera first, and then the camera seamlessly switches to the right-hand battery. If one of the batteries you put in is only partially charged, then it will be used first regardless of which slot it is in.

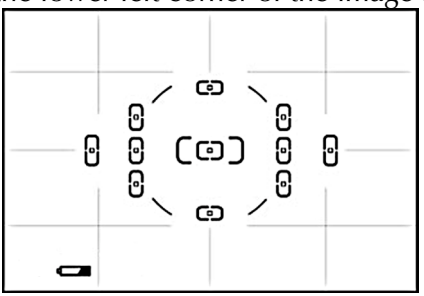
Battery Life

You'll probably be surprised to learn that the D80 uses very little energy when it sleeps between shots (<3mA). When turned OFF, it uses almost as much (typically <2mA). Thus, it makes little sense to turn the camera OFF between shots. The battery status is shown
on the top LCD:

Top LCD:



When only one "bar" remains (i.e., the battery is low) and you have the Viewfinder Warnings option set (Custom Setting #9, see page <410>), the viewfinder will show a low battery warning in the lower left corner of the image area:

Viewfinder: 

Nikon's manual gives two figures: 600 shots using flash every other picture and 2700 shots without it (there are some other small variables that change as well; I suspect Nikon was trying to suggest this as a likely range you might encounter). More rigorous testing produces some more useful data:

- *Shooting any form of NEF reduces shots per charge significantly*. This is an unexpected result, but similar to the D200. The only explanation I can think of is that something in the write-to-card mechanism is drawing power unexpectedly. But it's clear and repeatable: the minute you begin to shoot NEF your shots per charge reduces. This is *not* a manageable parameter; if you shoot NEF, you get reduced battery life, period.
- *A full image review on the color LCD reduces shots per charge by about half*. If you have **Image Review** (CSM #6) set to **On** and the **Monitor Off** time (CSM #27) set to the **10s** and don't manually turn off the image on the color LCD after the shot, you'll reduce your shots per charge by about half. This, however, is a manageable parameter, and the curve is predictable. Cut your image review down from 10 seconds to 5 and you reduce the battery impact by half (i.e. you'd get a 25% reduction in shots per charge).

Note: Most D80 users use the color LCD to review the histogram, but there's still a trick you can use to preserve a bit of power. After you've reviewed the shot for exposure, press the shutter release partway to activate the metering and autofocus systems. The camera thinks you're getting ready to take another picture and turns the color LCD off (normally, the image would stay on the color LCD until the LCD time-out is reached or until you pressed the ▶ button to turn it off).

No other factors are as critical to shots per charge performance as the two just mentioned. However, here are some additional tips on power consumption with the D80:

- *Use of autofocus lenses doesn't significantly contribute to power drain*. That's because it's a short draw of power. The peak may be over 500mA, but since it's normally such a short time during which this load occurs, it isn't a big deal (as long as you aren't repeatedly using autofocus between shots). The difference in power consumption using AF and AF-S lenses is negligible. But VR (vibration reduction) lenses reduce battery life by another 10% or more when the vibration reduction feature is used (the vibration reduction in the lens is powered by the camera). Since many users tend to keep VR active by holding the shutter release partway, VR use can shorten battery life.
- *Power consumption is highest when the camera is "active"* (metering [200+mA], focusing [500+mA], taking a picture [1000+mA depending upon settings], transferring images to the Secure Digital card, etc.). Reducing the amount of time the camera is active (metering and focus active) is another key to reducing power consumption. Thus, you'll get fewer pictures per charge if you leave the camera active for longer periods. You can cut the active timeout to 4 seconds via Custom Setting #28 (see "Meter/Camera Active Time" on page <438>).
- *Power consumption is also high when the camera is connected to a computer or to a PictBridge printer*. This is one of the reasons I recommend using an external card

reader for transferring files. While the camera is connected to the computer via the USB cable and the camera is ON, the camera consumes significantly more power than normal. It's not unusual to see the battery indicator go from full to half or half to empty when transferring from multiple, large cards or shooting tethered for a long period. The same is true for PictBridge sessions: the camera is drawing significant power the entire time it is connected to the printer, so remove the connection when you're not using it. Printing just 20 images with a Sony PictureStation printer connected dropped my battery power by almost half, for example.

- *The Lithium-Ion batteries of the Nikon D80 do not lose capacity over short periods of non-use.* If you store the battery for a long period of time, it will probably lose some charge, though. It takes very long periods of time to see significant power reduction on a battery not being used (a month or more). See "Battery Storage" on page <90>.

  On the other hand, the D80 isn't completely quiescent when the Power switch is in the **Off** position. In particular, the D80 uses an LCD overlay mechanism in the viewfinder, which requires a small, but constant power source. This overlay supplies the AF sensor markings, the grid lines and the iconic warnings (if enabled with CSM #9). You can verify this by looking through the viewfinder while removing the battery: the display will get darker without the battery in the camera.

  The consequence of the LCD overlay needing power is that if you store a D80 for a month, at the end of that month you'll have either a discharged or low battery. Moreover, you'll likely be running the battery fully down, which as I've already mentioned, is not the way to leave Lithium Ion batteries if they're not going to be used for a period of time. Remove the battery from the camera if you're not going to use it for long periods of time.

- *Cold can affect apparent battery life*. Lithium-Ion batteries have pretty good cold weather performance—I'd be surprised if you see any differences down to freezing temperatures—but they still will have a tendency to produce power for shorter periods in extremely cold conditions. If you must use the camera in sub-zero temperatures, carry a fully charged backup battery with you and keep that in a warm place (some outdoor apparel has inside pockets for just this purpose). As performance drops on the battery in use, swap it with the warm one.

  Cold doesn't actually "drain" a battery; it's the change in internal resistance at low temperatures that causes reduced function. So, once the replaced battery is again warm, it functions normally. You can usually juggle two EN-EL3e batteries this way and get the full number of expected exposures from each.

- *Fully charge your batteries*. When the charger indicates the battery is fully charged, it may not be. I generally leave my battery in for a short time after the charger indicates that the battery is charged. The test: if the battery is cool to the touch and the MH-18a light is in a steady on state, the battery is fully charged.

- *5% is about the point where you definitely want to change batteries*. It is okay to ignore the battery level right down to about the 5% mark without any risk of losing the next picture (this is for a single EN-EL3e battery; users of two EN-EL3e batteries in the MB-D80 can let the first battery run down completely but should follow this advice for the second battery). Below the 5% level you'll want to switch batteries if you can, as VR, autofocus, and other major power drains can catch you unawares and leave you without the picture you just shot. I'd double that cut-off value if I were tethered to a computer. That said, I've run batteries down to the 0% mark—the meter is that accurate.

  What I'm trying to point out is that once you're below the 5% mark, heavy current loads can make the camera

power down suddenly, so you usually want to replace batteries to avoid potentially missing a shot, especially if you're filling the buffer. In a pinch, though, you can take the battery right down to empty. If you do, I'd recommend you do it one shot at a time, though.

Overall, it's generally not a good idea to run your battery completely down (below 5%), as you risk a "deep discharge" cycle if you do and don't immediately get the battery onto the charger. You can take batteries down until exhaustion if you have to, but you shouldn't do this regularly, and you should immediately put a battery discharged this way on the charger, if possible.

Overall, the D80's battery performance is decent. By minimizing use of a few power-hungry features and shooting only JPEG, you can typically get by on one battery in a full day of shooting (and I mean *full*).

Two fully-charged batteries are all I've ever needed shooting NEF images on my D80 during a full day, and that seems to be true for others I've talked to, as well. (Again, this might not apply if you're shooting with the camera tethered to a computer or printing with PictBridge.) The problem for me comes with multi-day trips in the backcountry, where I used to be able to carry two EN-EL3 batteries with my D70 and come out the other end of the trail a week later still taking pictures. With the D80, that won't happen unless I shoot JPEG, so I have to carry five or six batteries and watch my power consumption more carefully.

The good news is that carrying extra EN-EL3e batteries isn't really a big burden. They're small and light. But if you find yourself going through multiple EN-EL3e batteries regularly on shoots, you might want to consider getting the optional MH-19 Multi Battery Charger, which can charge two EN-EL3e batteries (it does so sequentially, one at a time). It's pricey (more expensive than buying two MH-18a units, go figure), but if it lowers the number of gadgets you have to carry it might prove useful.

Battery Notes

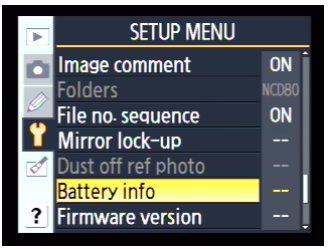
The D80's battery charger can be used worldwide, at any voltage from 100 to 250 volts. You *do* need to obtain the correct cables and/or adapters for the power socket, however. Sets of socket adapters can be found at any Radio Shack and most travel stores.

Since the D80 uses an intelligent battery system, you'll want to pay more attention to the information the camera tells you about the battery. Besides the usual battery status icon (on the top LCD), the D80 has the ability to tell you much more about your battery:

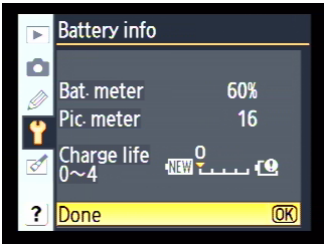
1. Press the **MENU** button to see the menu system.
2. Use the Direction pad to navigate to the SET UP menu (yellow wrench tab) and press the ▸ key on the Direction pad or the **OK** button to enter the menu.

Note: Often this step requires you to first press the ◂ key on the Direction pad to get to the tabs, then use the ▴ and ▾ keys to get to the yellow wrench tab. Since I haven't yet fully described how the menu system works (see "How Menus Work" on page <170>) and this is the first point in this eBook with step-by-step instructions, I've added this note just in case you can't get to the right tab. All subsequent step-by-step instructions will assume you've read this note or the section on how menus work.

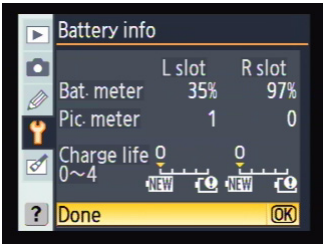
3. Use the Direction pad to navigate to the **Battery info** option and press the ▸ key or the **OK** button to select it.



4. The screen that is displayed next (below) tells you several useful things about your battery:



One Battery



Two Batteries

- **Bat. meter** (battery meter) is a precise value for the amount of power left in the battery.
- **Pic. meter** (picture meter) tells you how many images you've taken so far using this battery charge. If you're trying to estimate how many batteries you need for an event and you've been paying attention to this number (hint: look at it just before changing batteries) you'll have a very good idea. I routinely see values near or above 400 images when my battery is low when shooting NEF images.
- **Charge life** (charging life) tells you about how many more uses you can get out of this battery before you need to replace it. When the small yellow triangular indicator is above the right edge of the bar and reads **4**, you should consider retiring the battery and obtaining a new one, as it won't be able to hold charges well.

Image Storage

While the D80 has an internal memory buffer that *temporarily* stores data obtained from the sensor, it uses a Secure Digital memory card to permanently store digital images.

When you take a picture, the data is interpreted by the ADCs (Analog-to-Digital Converters) and image processor and then moved into an internal memory buffer. Images in the internal buffer are moved as soon as possible to the storage card. After an image is written to the storage card, the buffer space it used is freed up. Put another way: on the one side the D80's sensor and digital circuitry is filling up the buffer, while on the other side the storage circuitry is emptying it.

Having a memory buffer is a *very* important concept to understand, as it has practical implications:

- *Internal buffer memory space is limited.* The D80 can buffer up to 100 JPEG images in anything but the best quality, 23 JPEG Fine Large images (best quality), but only 6 NEF images and only 6 NEF+JPEG images. The camera cannot take additional pictures when the buffer is full. As images are written to the Secure Digital card, buffer space is freed. Any time that there is enough space remaining in the buffer for an image, the camera can again take a picture. When using the D80 set to a Continuous shooting frame advance, once the buffer is full the camera slows, essentially to the speed at which it can write a single image to the card. Card speed determines the frame rate in that case (e.g. faster cards produce faster frame rates when the buffer is full).
- *Internal buffer memory is temporary storage.* Images in the buffer are not accessible directly—only the camera's electronics can touch the buffer memory—and until an image is written to the Secure Digital card, your photo has not been "saved." If power is completely lost with images in the buffer, those images not yet moved to the storage card are also lost. When the camera is writing data from the internal buffer to the card a small green LED light on the back of the camera is lit.
- *Some controls impact buffer size.* Specifically, **Long Exp. NR** reduces buffer size.

Why does the camera need an internal buffer? Well, the D80 has to deal with a large amount of raw data for each image (ranging from 12.4MB for NEF to just ~300KB for the smallest JPEG). Even at reasonably fast write speeds to the Secure Digital card (~9.5MB/second), it takes a measurable amount of time to write these from the camera to the storage card. While JPEG images are much smaller in size, the camera still has to create that image from the original data, which also takes a small amount of time. Without a buffer, the camera would force you to wait a large amount of time between taking pictures. The buffer allows the D80 to be doing two

things at once (take another picture while handling the data for the previous one).

Note: The D80 can lose images. When you turn the camera off it may still be writing images from the buffer to the storage card. The green indicator light stays lit to indicate this—in other words, while you turned the camera off it is smart enough not to actually listen to you until the buffer is empty. But if you take the Secure Digital card out of the camera while that indicator light is lit, you'll not only lose some images, but you could corrupt the formatting of the card, potentially losing all the images on the card. So make sure the light is off before removing cards.

Tip: Here's one not many D80 shooters know about: you can clear *the buffer! This is done by holding down the Delete button (the trashcan: 🗑)* while *turning the camera off. The camera will finish writing the current image (so that it doesn't corrupt the card formatting) then purge the rest of the images in the buffer.*

Buffer Sizes

The remaining buffer is always shown by the **r** indicator[39] while shooting, so it is always easy to see where you stand in terms of remaining memory. But a number of options impact buffer size. Here's what my D80 says is available at my usual camera settings:

	Normal	*High ISO NR*
NEF+JPEG	5	2
NEF	5	2
JPEG Fine L	6	4
JPEG Fine M	6	4

Wait a second, what's with those numbers? After, Nikon says 100 for **JPEG Fine M** and 6 for **NEF** in their manual. The difference has to do with write efficiency. The figures the camera displays represent actual buffer size, but the camera is fast enough in writing that in Continuous frame advance you'll see the **r** indicator increment downwards more slowly than once per picture (with **JPEG Fine M** and a fast card, it never gets below **r2** on my D80). Thus, the numbers in Nikon's manual are *effective* buffer sizes.

Unfortunately, Nikon doesn't give a full set of numbers in their manual (only the "Normal" *effective* buffer numbers appear, and then only in the Appendix). Just remember that setting the noise reduction capabilities will reduce the effective buffer size.

To repeat, the D80 never reports more than 6 images available in the buffer, but if you set the camera up to shoot a series of images in Continuous frame advance, you'll note that, especially for most JPEG settings, the buffer remaining

[39]Both the top LCD and the viewfinder Shots Remaining indicator switch to a Shots Remaining in Buffer indicator when the shutter release is pressed partway, and a small **r** is used in front of the number to indicate this. What you don't want to see is **r0**, which means that the buffer is full.

indicator doesn't seem to count down with each image you shoot.

The numbers I report in the table above are safe: they represent absolutely worst case scenarios.

Note: If the number of images that can be stored on the card is less than the free buffer size would allow, the ***r*** *Buffer Remaining indicator indicates how many images are left on the card. Thus, as you get close to filling a card with images, you'll start seeing the Buffer Remaining indicator mimic the Frames Remaining indicator. Put another way, you can't put images into the buffer that can't be saved onto the card.*

Note: 100 is the absolute limit for any single press of the shutter release. In other words, when the camera gets to 100 continuous frames, it will stop, even as the buffer frees up. You have to take your finger off the shutter release and repress it to take more shots.

Secure Digital

In the United States, Nikon does not supply a Secure Digital card with the D80 (i.e., you usually must purchase one separately if your dealer didn't include one with the camera; though in a few cases I've noticed special deals where a card is bundled by the dealer with the camera).

Secure Digital is a very small card type that requires the camera to have all the necessary circuitry to communicate directly with the memory itself (CompactFlash cards have a more sophisticated intermediary "controller" in them that does some of the work).

As I write this, Secure Digital cards are available from a wide range of vendors in sizes ranging from 64MB to 8GB in size (the limit keeps getting pushed up; now that cameras like the D80 support FAT32, we're a long way from the theoretical limit).

Note: A card labeled **SD** *is probably 2GB or smaller in size and formatted as FAT16. A card labeled* **SDHC** *would be 2GB*

or larger and formatted as FAT32. If you format an SDHC card using FAT16 its usable capacity on the D80 is reduced to 2GB.

The D80 can hold only one card at a time, which means that when the card in the camera fills up, you simply swap it with an empty card, just like you'd load in blank film after exposing a roll in a 35mm film camera (make sure you turn the Power switch on the camera to **Off** before swapping cards, and don't do that until the green LED Card Write indicator on the back of the camera is no longer lit).

Alternatively, you can transfer the images saved on the card to your computer, then reformat the card. But since that takes time and access to your computer, most D80 users carry a few Secure Digital cards with them so that they can quickly get back to shooting.

You may wonder where the "secure" in the name comes from. Secure Digital is really a derivative of an older format, called MMC (multimedia card) with the addition of a digital rights management system to protect Copyrights. Companies can therefore produce Secure Digital cards with protected content on them that can't be copied (as in pre-recorded cards for MP3 players). For camera use, however, this feature isn't used.

Solid State Memory

Secure Digital cards contain nonvolatile memory chips that retain information stored on them even when power is not present. The originating parties of the Secure Digital design are Matsushita (Panasonic brand in the US), SanDisk, and Toshiba; almost a thousand companies now make products that support the standard. One of those, of course, is Nikon.

While not indestructible, Secure Digital cards are designed to withstand a 10-foot drop without damage, and they're relatively impervious to the elements (they shouldn't be immersed in water, however). If you keep your Secure Digital

cards in their small, plastic storage containers when not in the camera, they should last as long as the camera does.

Size of the card? About 1.25 x 15/16 x 1/16″ (32 x 24 x 2.1mm[40]).

The memory of a Secure Digital card is typically organized like a computer disk, complete with file directory, file allocation table (FAT), directories, and files (ironically, I find that a book I wrote over two decades ago, *Programmer's PC Sourcebook*, has detailed information on the structure digital cameras use). Like a disk, a Secure Digital card can develop "bad sectors" over time and files can become "fragmented" if you delete individual files. Fortunately, the act of using the D80 controls to "format" a Secure Digital card generally removes file fragmentation (as well as the files!).

Formatting a card using a card reader attached to a Windows PC *also* isolates bad sectors, but only if you avoid using the Quick Format option[41]. In general, however, I recommend that you stick to formatting your Secure Digital card using the camera, not your computer.

If you use one of Microsoft's more recent versions of Windows to format a card, such as Windows XP, be sure to

[40] There's also a "thin" version of SD that measures 1.4mm thick. This type of card can be used in a D80, as well.

[41] Virtually all disks and storage devices have a few "bad sectors" on them. That's normal, and all manufacturers "mark" these sectors with a flag in the tables at the start of the drive, so that the operating system doesn't use them. But if the flags get erased for some reason, they aren't restored with Quick Formats (which is what all digital cameras do, by the way). Likewise, if another sector eventually goes bad (which eventually happens on all drives), it isn't found and marked by Quick Formats. If all that isn't enough, there is a difference between a "low level" format and "high level," or "logical format." Bottom line: if you begin experiencing problems with a single storage card, try performing a *full* format of it on a PC. This may mark a sector that has gone bad and restore the usefulness of the card. If that still doesn't correct the problem, you'll probably have to return the card to the manufacturer for replacement.

specify **FAT** for cards smaller than 2GB, not the **FAT32** format normally used by a PC[42].

Secure Digital cards that have solid-state memory do have a limit to the number of times that they can be written to. Fortunately, you're not likely to hit that limit (usually in the hundreds of thousands of times) in the lifetime of your camera. For example, if you had a 128MB card that had a stated life of 300,000 writes, and saved only in NEF format, you'd have to shoot somewhere north of 5 million pictures before you hit the card's write limit. You're more likely to encounter problems with the body's shutter mechanism (typically good for 50,000 cycles) before you will with your Secure Digital card.

Different card types work at different speeds. At the time of this writing, the Lexar Professional 133x and SanDisk Ultra II cards seem to be about the fastest in writing large files on the D80. (In theory, the write mechanism in the D80 should max out with a 66x card, but in practice faster cards do produce slightly faster writes.)

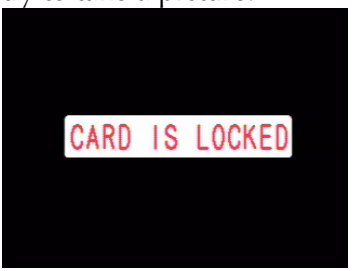
The card goes in connector-edge first (edge with notch), with the main label facing the outside of the camera (towards the back of teh camera). You'll feel a bit of resistance when you've pushed the card most of the way in—you need to continue to push until the card is fully engaged with the connector inside the camera.

[42] The D80 supports FAT32, but using FAT32 on cards that are 1GB or smaller is inefficient. Unless you have a card at least 1GB in size, use plain 'ole FAT. Moreover, Macintosh users don't have easy access to FAT32 facilities. If you know what you're doing, you can drop down into the command line interface and use something like `newfs_msdos -F 32 -b 32768 /dev/disk1` to format your card, but this is a utility for advanced users who know what they're doing.

Using Secure Digital

To insert a Secure Digital card in the D80:

1. Turn the Power switch to the **OFF** position.
2. Open the door covering the card slot. This is done by sliding the door towards the back of the camera, at which point it should spring open.
3. Examine the Secure Digital card and make sure that the switch on its side is *not* in the **Lock** position. Like floppy discs, Secure Digital cards have a Write Protect switch. In the **Lock** position, the camera cannot write to the card.
4. Insert the Secure Digital card (connector end first, label side *towards* the back of the camera facing you; the camera prevents you from inserting it incorrectly, so if seems like you need to use excessive force, you're probably inserting the card backwards). You have to push the card all the way in until it "clicks" into place.
5. Close the door that covers the Secure Digital card slot by folding it back from the sprung position and sliding it forward on the camera.
6. Turn the camera's Power switch to **ON**. If the camera briefly blinks CHA and 0 on the Top LCD, then simply displays 0 on the Frames Remaining indicator, the Write Protect switch on the card is probably set to **Lock**. The camera also displays the following if you try to take a picture:



Remove the card and try again, paying particular attention to Step 3.

Tip: It is possible to "take" pictures without a card in the Secure Digital slot if Custom Setting #5 has been set to **OFF** *(see "Lock Camera with No SD Card" on page <403>). With this setting, the camera acts like it takes pictures, but because there's no card in the camera; nothing will be saved (unless you're connected to a PC running Nikon Capture). If no card is present in the camera, you'll see an -E- on the top LCD on the Frames Remaining indicator.*

If you haven't previously used the Secure Digital card before inserting it into a D80, or if the card contains images you no longer need, you should format it (see "Formatting Cards with the Camera" on page <115>).

Once the card is formatted, the Frames Remaining indicator resets and shows the number of images you can take at the current image quality setting (if that number is larger than 1000, then **K** is displayed just above the Frames Remaining indicator).

Note: Formatting a Secure Digital card "removes" ***all*** *information and images from the card. Always save your images to a computer before formatting a card! I use the quotes around "removes" because the image data isn't actually erased; only the directory information that points to it is rewritten. While it is possible to recover images immediately after performing an in-camera format, it is a hassle to do, and won't be fully successful if anything has been written to the card since the format.*

The D80 tells you when a Secure Digital card is full by blinking FULL and 0 in the Frames Remaining indicators (top LCD and viewfinder). The card isn't necessarily full, however. It just doesn't have enough room to store another picture at the current image quality setting.

Tip: If you've been shooting using **NEF** *or the* **NEF+JPEG** *qualities, both of which chew up considerable space per image, you can often squeeze a few more JPEG-only images onto the card because the JPEG compression makes the resulting image files much smaller.*

To remove a Secure Digital card from the D80:

1. Turn the Power switch to the **OFF** position. *Important:* Before moving to Step 2, confirm that the green Write Access lamp is not lit (the camera does not completely shut down until buffer data is written to the card).
2. Open the door covering the card slot by sliding the cover towards the back of the camera.
3. Press in on the edge of the Secure Digital card. The card is spring loaded in the slot and should pop out slightly, allowing you to grab its edge.
4. Remove the card from the camera.
5. Insert another card into the slot, if desired.
6. Close the door that covers the Secure Digital slot.
7. Turn the camera **ON**. Check to make sure the Frames Remaining counter shows that you have frames available, and not CHA or 0. (If you see CHA, try removing the card and flip the Write Protect switch from the **Lock** position; if you see 0, try using the camera's **Format** command to erase the card.)

Nikon-Approved Secure Digital Cards

Nikon makes a big deal about "operation not guaranteed" unless the Secure Digital card has been tested and approved by Nikon. Unfortunately, their list of tested cards is short:

- SanDisk cards from 64MB to 4GB
- Toshiba cards from 64MB to 2MB
- Panasonic cards from 64MB to 2GB
- Nikon 1GB card

I've used a range of other cards in the D80, including some generic ones, and have yet to find any that cause operational issues with the camera. Unfortunately, Nikon doesn't think that. I've received multiple reports from users who've contacted Nikon technical support about a digital camera problem and were dismissed out-of-hand for "not using an

approved card."[43] Don't let it be an issue: spend a couple of dollars to purchase one of the approved cards at a low capacity (e.g., 64MB SanDisk, which is commonly available) so that you can verify that anything you report isn't "card related."

Formatting Cards with the Camera

Like other Nikon DSLRs, the D80 supports a two-button format (two buttons marked with a red FORMAT are held down and used to initiate the formatting process); alternatively, you can use the menu system.

If you haven't previously used the Secure Digital card before inserting it into a D80, or if the card contains images you no longer need, you should format it as follows:

1. Put the card into the D80 (with the camera's power off).
2. Turn the D80's power switch to the **ON** position.
3. Hold down the two buttons labeled FORMAT (in red) for two seconds. (One is on the back left of the camera [🗑 button]; the other is just in front of the top LCD [⊡ button].) When the top LCD begins blinking the label For, release the buttons.
4. Immediately press the two FORMAT buttons again. Formatting time varies with the size of the card; a fast 1GB card usually takes a few seconds. The top LCD shows For in the Frames Remaining indicator while the camera is formatting.

Note: Step #4 is a bit confusing to new D80 users. Apparently, Nikon didn't think that holding down two buttons once for two seconds was a unique enough combination to preclude

[43] Shortly after my D100 eBook stating the same thing first appeared, NikonUSA apparently changed their internal policy regarding non-tested cards. According to my talks with NikonUSA Technical Support, they are instructed to no longer refuse to troubleshoot problems for customers using non-supported cards. Still, I keep a supported card on hand—this way we can skip through the troubleshooting steps that try to isolate whether it has to do with the particular brand of card or not.

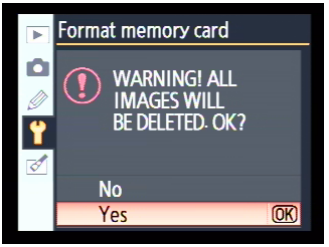
accidental formatting. Since erasure is a permanent loss of data, I agree with Nikon's conservatism here.

Once the card is formatted, the Frames Remaining indicator resets and shows the number of images you can take at the current image quality setting (if that number is larger than 999, then **K** is displayed just above the Frames Remaining indicator; 1.7 in the Frames Remaining indicator with the **K** also showing would mean 1700 frames can be taken).

Alternatively, to format a Secure Digital card in the camera using the menu system:

1. Press the MENU button to turn on the color LCD.
2. Use the Direction pad to navigate to the SET UP menu (yellow wrench tab). Once you've highlighted the appropriate tab, press the ▸ key or **OK** button to enter the menus for that tab.
3. Use the Direction pad to navigate to the **Format memory card** option and press the ▸ key on the Direction pad or **OK** button to select it. (If the option is grayed out, make sure you have a card in the camera!)

4. Use the Direction pad to navigate to **Yes** and press the **OK** button to complete the action.



Secure Digital Troubleshooting

Problem: The capacity of your Secure Digital card seems to be a little less than the one stated on the label (e.g., you seem to only be able to store 114MBs of data on a 128MB card).
Solution: Actually, this is normal. Secure Digital works just like a disk drive on a computer, with an area set aside for a file allocation table and a file directory. In addition to the reserved space, storage manufacturers sometimes use 1K to mean 1000 instead of the more correct 1K=1024. Also, the number of folders created has a small impact on overall capacity. Like disk drives, sometimes areas of the card are marked as "bad," and this, too, reduces capacity.

Problem: It seems to take longer to store information on a Secure Digital card than it did when you first obtained it.
Solution: If you erase individual files instead of reformatting the card, it's possible to get file fragmentation on the card. When this happens, data for any given file is non-adjacent, and the camera has to write extra information into the file directory. This, in turn, can cause slightly longer write times due to the extra information that must be written in the directory.

Likewise, it's possible for cards to get lost clusters[44] and files

[44] Clusters are the basic unit in which information is stored on disk drives (and Secure Digital). A file is made up of many clusters, and the directory and other information stored at the beginning of the disk keeps track of which clusters belong to which files. When a cluster is "lost," the information tracking it uses has been damaged or erased. This means that your data may still be intact, but that the structure of the disk is incorrect, hiding that data. As noted elsewhere, having a good disk recovery utility

on a card. Use the camera's **Format** option to erase all information from a card instead of individually deleting files.

Alternatively, you can reformat cards on your computer if you have a card reader (it works just like formatting any disk drive—open a window for the drive in Explorer [Windows] or Finder [Macintosh] and use the normal formatting procedure for drives; just make sure that you pick **FAT**, not **FAT32** if you're using a recent version of Windows, such as XP, and aren't using a 1GB or larger card). However, I generally don't recommend formatting cards on a computer unless the camera is specifically having an issue with the card that a full formatting might fix.

Problem: You get occasional "black" frames instead of images.
Solution*:* There's likely a bad sector on the card that isn't marked as such. Another symptom is sometimes excessively long writes to the card (or the green "writing to card" light stays ON), or you get large black areas through your images. You need to perform a *full* format[45] on the card using a card reader attached to a PC (which should detect and mark bad sectors). However, if black frames appear on more than one of your cards or on a regular basis, you should have your camera checked by Nikon. Black frames are also a possible indication of a shutter problem on D80 bodies.

Problem: You can't find images on the card or the computer complains about damaged files when you try to transfer images from camera to PC.
Solution*:* One of several problems is likely present on the card: (1) the FAT (File Allocation Table, which tracks clusters in use) is corrupt; (2) the directory has incorrect information about files, usually either cross links of data between two images or missing cluster information; or (3) something else is wrong with the data or structure on the card, such as a

handy can sometimes help you retrieve precious photos you thought the camera had lost forever.
[45] Note that the Windows default is to perform a *quick* format.

damaged sector, an incomplete file, an unexpected End-of-File marker, and so on. In every case, you must *immediately* fix the problem or risk the permanent loss of your image data. You may or may not be able to fix the problem, but if anything gets written to the card before you begin attempting a correction, your ability to recover data is compromised. Macintosh users should be extremely careful when mounting problematic cards on their computers, as several behind-the-scene tasks can write to the card without your knowledge.

So how do you fix the structure and data and recover your images? The best choice is to use a product such as Photo Rescue (http://www.datarescue.com/photorescue). This tool—versions are now available for both Macintosh and Windows—generally can find and recover images that are the result of most structure errors, though you may have to go into the advanced mode and play with some of the settings in order to do so. Current versions of Photo Rescue understand the NEF format, and can resurrect a raw data file, complete with the proper extension. If you haven't written anything to the card after the error occurred, you can often recover every image on the card. Note that to use Photo Rescue you need to connect the camera to the computer, or you need to put the card into a card reader attached to your computer.

Generalized disk tools (like Norton Systemworks or SCANDISK) know nothing about image file formats, so they usually can't scan data on the card and resurrect orphaned data or rebuild incomplete image files. Personally, I travel with Photo Rescue installed on my laptop and a card reader that can mount Secure Digital cards.

One other point: if you move cards between cameras, sometimes the reason why you can't find images is because they're stored in separate folders for each camera (see "Folders" on page <153>).

Image Formats

The D80 saves images to the Secure Digital card in two image formats, JPEG and NEF:

- Saving an image in JPEG format performs the necessary steps to convert the sensor data into an image using the camera settings that are in effect, reduces the 12-bit capture data to 8 bits, copies the camera settings into the EXIF fields, and applies data compression that loses image information. (Unlike all previous consumer Nikon DSLRs, all D80 manipulations of the image data are done in 12 bits prior to reducing to the final 8 bits required by the JPEG format.)
- The NEF format "preserves" the sensor data[46] along with copying the camera settings into the EXIF fields. In addition to the raw sensor data, NEF format also stores a **JPEG Normal** image as a "thumbnail."

If you want the highest quality image the D80 is capable of, use NEF (though note that the latter requires that you use appropriate software to decipher the data; see "NEF Format" on page <137>). If you know your way around digital image editing programs and immediately convert your JPEG files into a lossless format, such as Adobe's PSD (Photoshop data) format, the actual loss of data using JPEG can be kept essentially invisible, at least at moderate viewing sizes.

I should probably take a moment here and elaborate on a sentence in the previous paragraph (the one that starts "If you want the highest quality…"). The primary difference between JPEG and NEF is that, for JPEG the camera's electronics have to do all the work of assembling an image from the data and your settings, while with NEF that work is postponed until you get the image data to a computer. JPEG (potentially) suffers from four things that can "harm" image quality:

- *The camera's electronics are static*. They're only as good as the state-of-the-art in early 2006 when they were locked down in design. Those of us who've been using DSLRs for years know that image processing software is

[46] *Preserves* is in quotes because the D80 doesn't really preserve the actual 12-bit values when it stores in the compressed NEF format, instead using a "visually lossless" compression format.

still getting better every year. By delaying the processing, you potentially can take advantage of image techniques that came to be after the camera was designed.

- *The camera's electronics "reduce" the data set*. In particular, tonal data is reduced from 12-bits to 8-bits in the process of creating a JPEG image. That's not a big issue if you never post-process your images, but it can be if you make drastic changes in software post-processing of the image. Note that the D80 doesn't actually reduce the data set until it's done manipulating the image data and puts it into final JPEG format. All in-camera adjustments are made in 12-bit by the D80. Still, if you're going to make any changes after the fact to the image, the final 8-bit data storage size is a limiting factor.
- *The camera uses the settings you made*. Make a mistake on setting white balance, sharpening, or some other camera setting? Well, with JPEG that mistake is encoded into the image data, and it'll take careful post-processing to take it back out (if that can be done—not all such mistakes can be undone). NEF allows you to alter many of your camera settings after you've taken the picture.
- *JPEG involves compression*. The final step of taking the manipulated image data and putting it into a file format that can be understood by most software also involves a compression step that has the potential to "lose data." No, I don't mean that some pixels disappear, but rather that the original value of that pixel may be altered slightly and not recoverable. I'll have much more to say about that in the section on JPEG that comes in a few pages.

If you're getting the feeling that I'm strongly in favor of the NEF format, you're right. For serious photographers, shooting in NEF is like retaining and working with a negative while JPEG is like accepting the print that comes out of the lab. The reason most amateurs avoid NEF format is that they don't want to spend any time post-processing their images. Likewise, some event photographers shoot so many images that post processing all of them would take too much computing power and time.

Fair enough. Just realize that you're going to have to make some choices about how you shoot with your D80, and JPEG versus NEF is one of the key ones. Make sure you're making the right decision for yourself[47].

Okay, let's delve into the details so you can better understand what you just read.

Pixels

Before we get to the individual data formats, let's make sure that we have some basic understanding of the underlying element used in them: pixels.

A pixel is the smallest element of a digital picture. You've probably seen camera resolution figures expressed in the form of two numbers, say 3872 x 2592. This means that the camera produces results that have 2592 rows containing 3872 columns of data. At each row/column intersection, there's a pixel, which is used to describe the color that should be displayed there.

Pixels contain color information, usually expressed as individual values for red, green, and blue[48]. Each color value is stored in a series of bits. Bits are the smallest data elements computers understand; a single bit has a value of either **1** or **0** (thus, an example 8-bit value is **0100 1101**). While the D80 is capable of producing 12-bit values for each color (assuming you shoot NEF and use a converter that retains that data),

[47]JPEG shooters should note that the D80 does a pretty darned good job of rendering images in the camera. In particular, the noise reduction in-camera is quite good and difficult to equal or better in raw file conversions. It's not that JPEG quality is *bad*, it's that NEF quality *can be* better in the right hands. By these comments I don't mean to try to scare anyone off from shooting JPEG—I do it myself from time to time when the situation warrants it—but only to point out that you give something up by doing so.
[48]When I write about the Red channel, Blue channel, and Green channel elsewhere in this eBook, I'm referring to these individual color data points.

most computer imaging programs, including Photoshop, normally use 8-bit values for most work[49].

In computer jargon, eight bits are called a byte, and most disk and memory storage capacities are expressed in bytes. For example, the main memory of your computer might have 67,108,864 bytes (64MBs) of space. The non-round number is caused by the binary nature of computers, where everything is expressed as a power of 2. A thousand in computer counting turns out to actually be 1024; therefore most storage capacities are slightly understated. Secure Digital cards used by the D80 have storage capacities expressed in bytes, as well.

To form one complete digital image you must store 24-bit (for JPEG) or 12-bit (for NEF) values for each pixel. Why 24-bit for JPEG? Remember, we need 8 bits to store each of the three primary colors for JPEG files, while NEF files just contain a single 12-bit data point for each photosite (the color information is deciphered later). You do this in a compilation of bytes called a file. On a D80 at its highest in-camera resolution, that amounts to a minimum of 30,108,672 bytes of data (3872 x 2592 pixels at 24 bits each), which we'd normally just round off and call 30MB. That means that a file containing that image would contain a string of over 240 million **1**'s and **0**'s. Actually, slightly more than that, since most file formats require some additional information that describes the characteristics of the data in the file. (Puzzled by the 240 million number? Remember, there are 8 bits in a byte!)

To put that in perspective, this eBook only has close to a million characters in it, so if you took every letter in this eBook and made it into a **1** or a **0**, you'd need almost 250 eBooks just to contain the data for one image.

[49]Photoshop CS2 allows most of its image editing tools to function with 16-bit data, but since all consumer printers and almost all commercial printers only accept 8-bit data, most people still use Photoshop only with 8-bit data.

Obviously, we're talking about a huge amount of data. To help deal with the storage issues all that data raises, Nikon *compresses* the image data (i.e. makes image files smaller). This is true for both JPEG and NEF files on a D80.

JPEG

The D80 normally stores images in JPEG format[50] (in Windows, the three-letter file extension limit reduces this to **.JPG**, so you may also have seen this format referred to as JPG). JPEG (pronounced *JAY-peg*) stands for Joint Photographic Experts Group, which developed and ratified the original standard for this file format.

JPEG files can be read by a wide variety of programs, and is one of the file formats directly supported by HTML, the standard language from which Web pages are created.

The wide acceptance of the JPEG format means that you can share a JPEG-encoded file with others, regardless of what type of computer or software they have.

To produce a JPEG file from raw digital information, the following steps are performed (note that the words in parentheses are gross oversimplifications to help you understand the process):

1. The image is divided into 8 x 8 pixel blocks.
2. The information in each block is run through a series of "transforms" (calculations) to produce a set of 64 "coefficients" (results) that are then "quantized" (compressed)[51]. Essentially, pixels are converted from numbers into equations (the calculation used is called

[50]Technically, JPEG isn't a *file format*, but simply a data compression scheme. However, the fact that most computers use a file extension of .JPG or .JPEG for such files has caused users to call it a file format. I'll bow to this common practice in this eBook.

[51]An aside: which set of words you use (transforms, coefficients, quantized or calculations, results, compressed) depends upon whether you're a mathematician or a layperson. A nerdy party trick is to use the vocabulary of the one you aren't.

a Discrete Cosine Transform). Blocks are operated on from top left to bottom right. Essentially, detail within each 8 x 8 pixel block is reduced, the amount of reduction determined by the amount of quantization (compression) applied.

3. The quantized (compressed) results are gathered into a single binary sequence, and this sequence is further encoded in a scheme called modified run-length algorithm, which generally produces further compression of the information (run-length encoding assigns the shortest bit sequence to the most-often-used pixel value, and the longest bit sequence to the least-used pixel value).

Note that compression happens twice when a JPEG file is created. The first compression is variable in level, but results in *permanent* loss of information. Generally, it takes a JPEG compression ratio of 10:1 or more to produce annoying artifacts (see "JPEG Artifacts" below). JPEG compression ratios of 4:1 or lower produce virtually imperceptible artifacts in most common photo scenes. The second compression step (run-length encoding) is lossless, meaning that the original information—in this case, the discrete cosine transform formula—can be fully retrieved.

The D80 can produce photos encoded in JPEG format. The D80 uses approximately 4:1 compression when set to **Fine**, 8:1 compression when set to **Normal**, and 16:1 compression when set to the JPEG **Basic** option. (This is the "lossy" compression, so **Fine** is visually "better" than **Basic**.)

Note: There is wide variance in the way JPEG compression levels are presented in software user interfaces. Some programs show you the approximate compression amount as a ratio (e.g. 4:1), some use descriptions (e.g. "high," "moderate," and "low" or Nikon's "fine," "normal," and "basic"), and still others use sliders and other controls to continuously vary the amount of compression. The best programs show you a preview of the resulting compression, letting you visually determine how much compression to use.

One interesting side note about JPEG: the process that converts the pixel values into equations ends up putting the "average" pixel of each 8x8 block in the upper left corner of that block prior to compression. Nikon doesn't use this average pixel directly (the D80 generates the image's thumbnail using other methods; some older Coolpix models used this pixel to generate the thumbnail).

Thus, if you want to create smaller images from the JPEGs that the D80 produces (say for Web use), the highest quality will be obtained if you reduce the size to 1/8 (e.g. 484 x 324 from the **Large** JPEG size created by a D80). That's because you'll force your image editing program to summarize the 8x8 blocks used in generating the JPEG, and minimize any artifacts that might be otherwise produced.

Setting JPEG

The D80 allows you to create three sizes of JPEG images:

L = **Large** = 3872 x 2592 pixels
M = **Medium** = 2896 x 1944 pixels
S = **Small** = 1936 x 1296 pixels

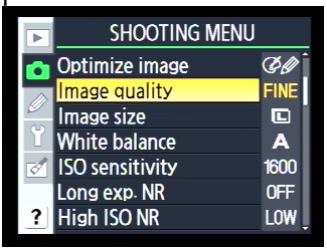
Put into a table:

JPEG Size	***Pixels***	***Total Size***
Large	3872 x 2592	10mp
Medium	2896 x 1944	5.6mp
Small	1936 x 1296	2.5mp

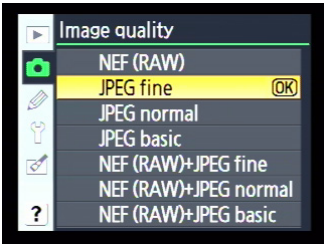
To set the D80 to record JPEG images:

1. Press the **MENU** key to show the menu system.
2. Use the Direction pad to navigate to the SHOOTING menu (green camera icon tab).
3. Use the Direction pad to navigate to the **Image quality** option and press the ▸ key on the Direction

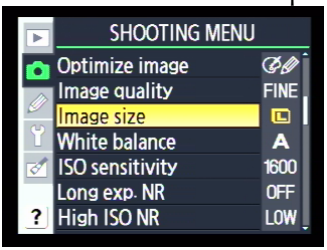
pad or the **OK** button to select it.



4. Use the Direction pad to navigate to the JPEG quality you wish to use (**JPEG fine**, **JPEG normal**, or **JPEG basic**), and press the ▸ key on the Direction pad or the **OK** button to select it.

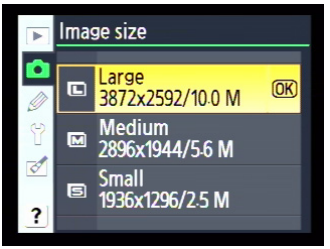


5. Use the Direction pad to navigate to the **Image size** option and press the ▸ key on the Direction pad or the **OK** button to see the options.



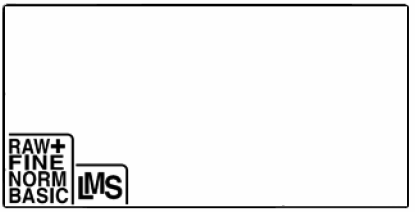
6. Use the Direction pad to navigate to the JPEG size you wish to use (**Large (3872x2592/10.0M)**, **Medium (2896x1944/5.6M)**, or **Small (1936x1296/2.5M)**, and press the ▸ key on the Direction pad or the **OK** button

to select it.



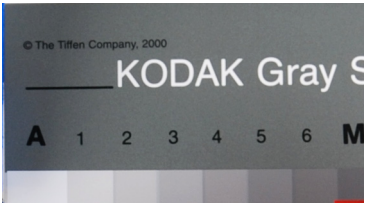
Alternatively, **Image quality** can be set by holding down the **QUAL** button on the back of the camera and rotating the Rear Command dial; **Image size** can be set by holding down the **QUAL** button and rotating the Front Command dial:

Top LCD (only one of the options is highlighted at time):

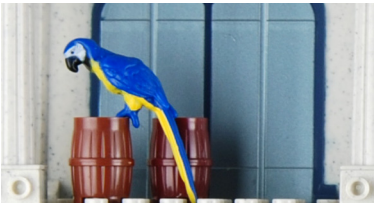


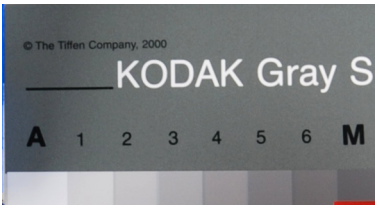
Let's examine how the three JPEG options impact the look of an image. Surprisingly, there's not a very big penalty for using the various JPEG settings. My overall test scene looks like this:

This is a tough, mixed lighting, high-contrast scene that attempts to provoke the D80 into worst-case images. Some of the colors will go out of gamut in some of my tests—this is intentional (like I said, a worst-case test). White Balance is set to **Auto**. *ISO is 100.*

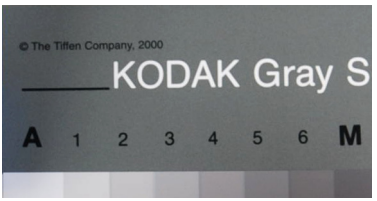


JPEG fine. At the camera defaults, this setting does a fine (pardon the pun) job of balancing detail rendering versus file size. No particular flaws are evident. If you look closely at the 400% "KO" detail at the bottom, you'll see that there is a slight blur to the white/gray edges. This is normal and due to the antialiasing all digital cameras produce. But the edges are otherwise clean.





JPEG normal. At ISO 100, the differences between **fine** and **normal** are almost non-existent. You might see the first hint of staircase artifacts on the diagonal in the K, but most people won't notice that. At higher ISO values, though, noise in the image will start to make such changes a little more obvious. Overall, a very good performance, and one that suggests that you can use this setting to save some storage space under low ISO shooting.



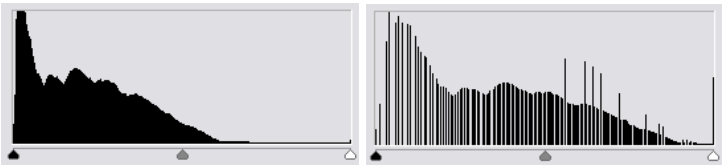
JPEG basic. Still a good performance at ISO 100, but now we have some more visible things to look at. In particular, look very carefully at the edges between the white and gray in the "KO." You should see that on the gray side there's a hint of dark gray, and on the white side, there's a hint of "whiter" white. This appears to be the default sharpening starting to be exaggerated by the JPEG artifacts. You may also notice some "splotches"

in the gray caused by the JPEG compression. As you increase sharpening and ISO settings, both of these artifacts will increase in visibility if you shoot with **JPEG basic**. To me, this JPEG setting is a last resort, and only usable at the lower ISO values.

JPEG Rendering

The D80 renders JPEG images a bit differently than previous Nikon DSLRs other than the D2xs and D200. While not publicly talked about, apparently Nikon is using a NuCore JPEG engine to do the actual rendering. What is known is that all manipulation of the image is first done using 12-bit data. The translation to 8-bit JPEG is made only after all the demosaicing, color manipulation, sharpening, and other effects are first handled. In other words, the D80 takes the 12-bit raw data, renders a 12-bit set of pixels, and then reduces that to 8 bits only at the point where the actual JPEG encoding is performed.

While this doesn't sound earth shattering, it does have an impact on the images the D80 produces. When you apply sharpening, tone curves, or color manipulation on 8-bit data, you risk posterizing bits of the data. Posterization means that some bit values just don't exist. Too much posterization can result in visible artifacts, usually "bunched up" or unnatural tonal ramps. The problem is compounded if you take an 8-bit rendered image and do additional post processing on it.



Left: a histogram from an image using Photoshop's Levels command.
Right: the same image overly manipulated, which reveals big posterization (gaps) in the darker levels. Posterization of highlight detail makes for detailless highlights; posterization of shadow areas makes for blotchy looks in the shadows. Once image data has been posterized, each additional manipulation can compound the problem.

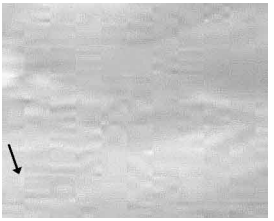
For example, one typical problem found by D1x users was that they'd underexpose slightly to make sure highlights were properly captured, and later use a Curve to reshape the tonal ramp (similar to what the example shows above, actually). Unfortunately, posterization in the shadow detail would often then become visible, resulting in a blotchy, muddy look in the darker areas of the image. By keeping the in-camera manipulations in 12-bit data, the D80 avoids this problem. Shadow detail in JPEGs made on a D80 is much better than most previous consumer Nikon DSLRs (though a bit noisy at high ISO values).

JPEG Artifacts

JPEG compression produces two primary types of visible artifacts. The higher the compression used, the more visible these artifacts tend to be. Also sharpening set to high levels tends to trigger these artifacts.

The first artifact is best described as "visible blocks" (see example, below). Visible blocks are created because JPEG operates on images in 8x8 pixel blocks.

Blocks are most often seen in areas where there is little detail but a continuously variable color (shading on an unevenly lit wall, for example). The quantization step attempts to throw away minor differences in colors or gradients, but when there is a gradual change of color that spans blocks, the block averages sometimes differ enough that you can see the block boundaries.



JPEG "blocks" tend to appear in broad areas of gradually changing color, as in the highly magnified portion of sky, here. To the right of the arrow, you'll see several left edges of blocks. The blocks don't always appear in 8x8 pixel size. This sky, for example, varied gradually from top to bottom, but not left to right, resulting in bands of blockiness rather than distinct blocks. (I've exaggerated the contrast to make the blocking more visible.) I find it very difficult to get any block artifacts generated by the D80, even using **JPEG basic**.

Here's a clear example of the mosquito artifact at work. Look closely at the edges of the letters in this example. All the letter edges have clear edge issues. Note how these look like a "fuzz" or swarm of mosquitoes at each distinct edge. The insides of the P and R in the word "PRODUCT" are also completely white, a related artifact that occurs when the space between two items is so small that, instead of putting mosquitoes in the space, the JPEG rendering simply does nothing.

Curiously, applying a small amount of "blur" to the original data before applying JPEG compression reduces the visibility of artifacts and the size of the resulting file. That's because hard edges contain conflicting data the compression scheme needs to resolve, and more bits are needed to hold that information. Setting high levels of sharpening with JPEG files at high ISO values should be avoided, when possible, with the D80.

The D80 is a bit like the D100 and D200, though: something in the JPEG rendering scheme used tends to make **JPEG fine** and **JPEG normal** images relatively immune to over sharpening and edge artifact issues, at least at lower ISO values. Indeed, if you run a resolution test on both JPEG and NEF images from a D80, you'll find that the NEF image

resolves slightly more detail, an indication that JPEG encoding is "smoothing" edges a bit.

(Just in case it's not clear from the preceding: it's okay to use higher levels of sharpening on D80 images at the lower ISO values and higher JPEG quality levels. It's not okay to use higher levels of sharpening if you're using higher ISO values and lower JPEG quality levels.)

Note: If you rotate a JPEG file and resave it, you may lose information! That's because each 8 x 8 block must be rotated in place to preserve its compression information. If an image editing program simply grabs rows of pixels and converts them to columns, when you resave the file, a JPEG recompression may again be applied to the entire file. If the 8x8 blocks are rotated in place and each block individually placed in the new orientation, JPEG compression is preserved and no new recompression takes place.

ACDSee, IrFanView, Photoshop CS2 and a number of other programs can rotate JPEG files without recompressing. Nikon's supplied PictureProject also preserves data during rotation (and can do so automatically during downloads if you've set **Image Rotation** to **On***). But make sure you know what the programs you use do! Older software programs (pre-2003) tend to recompress rather than rotate correctly.*

Note: There's a persistent myth circulating that any time you resave a JPEG file that you'll force a full recompression of the file, adding artifacts. Well written software doesn't do this. For example, beginning with version 6.0 of Photoshop, the only recompression that is done on JPEG images that are resaved is on portions of the image that were changed. In other words, if you bring a JPEG file into Photoshop 6 (or later version) and make no changes, resaving it results in no degradation of the image.

This is probably a good point to introduce the interaction effect of certain camera features, since I've already mentioned a few. The D80 does have a few image quality issues that you need to be aware of, and we've come to one of them.

- *JPEG compression has a tendency to increase the visibility of moiré*. For example, if you're shooting a tight fabric pattern—which might generate moiré—you probably should avoid high levels of JPEG compression and sharpening together. Put those three things together—moiré, JPEG compression artifacts, and sharpening artifacts—and you're asking for trouble. It'll be extremely difficult to remove the color fringing that'll occur.
- *Higher JPEG compression produces more artifacts at higher ISO levels*. The noise on the D80 tends to be very granular and visible at high ISO levels, and this triggers the compression engine towards mosquito-type artifacts on hard edges. Avoid **JPEG basic** at ISO 800 and above.
- *JPEG compression interacts with sharpening at high ISO levels*. Again, it's the noise that's the problem, but sharpening can further trigger excessive artifacts on edges. Again, avoid **JPEG basic** at ISO 800 and above, and definitely consider lowering the sharpening level as you increase the ISO value.

In each of these cases you can create image defects that won't be easily removed after the fact. Moiré can sometimes be removed (or at least downplayed) by moiré removal tools (or a bit of well-applied Gaussian Blur), but if JPEG edge artifacts get melded into the image data along with moiré or sharpening, all bets are off.

I'll describe these interactions more when I get to the shooting suggestions later in this eBook.

Overall, however, the D80 exhibits very little tendency towards producing JPEG artifacts at the lower ISO values. Only at high ISO values do I see mosquito-type effects, and some of this is actually noise destruction of edges that triggers JPEG rendering issues. JPEG blocks are almost non-existent on the D80, probably because the data is kept in the 12-bit realm while manipulating it.

NEF Format

NEF format often confuses D80 novices (Nikon and others sometimes also refer to this format as RAW). Nikon advertises it as the highest quality format, one that preserves the "raw" image photosite data. What Nikon doesn't tell you is that you need to purchase an additional software product to really get the most from this format[52]. Nikon Capture NX is what Nikon recommends, but other alternatives exist (see "D80-related Software" on page <604>).

The only non-trial NEF software you get with the camera is simply a plug-in Import filter for Photoshop that gets installed when you install PictureProject[53]. While this Import filter allows you to bring NEF images into Photoshop[54] and gives you some ability to change settings, such as exposure and basic white balance values, you don't have the full control you'll find in Nikon Capture. But even if the Import filter is all you have available, you'll still be able to generate better quality images using NEF than you can with any of the JPEG formats.

Note that the data saved in a D80 NEF file is exactly what comes from the Bayer-pattern sensor in the camera (well, not quite since it's been compressed; more on this in a bit). The data is packed as two 12-bit values in every three bytes (three bytes = 24 bits).

When unpacked, the first pixel in the top row is 12 bits of green data, the second is 12 bits of red data, and this pattern alternates throughout the first row. The second row starts with 12 bits of blue data, then 12 bits of green data, and then this

[52]A fully functional 30-day trial version of Nikon Capture NX can be downloaded from Nikon's Web sites by D80 owners (you may need to create a user account and supply your camera's serial number).
[53]My recommendation: don't.
[54]Photoshop CS2 and Photoshop Elements 3.0 and later also include an Adobe-supplied raw conversion capability. Depending upon when you acquired your copy, you may need to download an update to the Adobe Raw Converter from Adobe's Web site. At the time the D80 was introduced, Adobe RAW Converter didn't support the D80, but version 3.6 of the converter now supports the D80.

pattern repeats. No interpolation or corrections are applied to this data—NEF files contain essentially what the Analog-to-Digital converter deciphered from the sensor (with that pesky compression I'll eventually get around to talking about). This is one reason why NEF files require special software to decode; the sensor data must be converted (demosaiced) into RGB data and color corrected.

Tip: *If you're a programming wizard and want to know the exact format of the NEF files, here's a quick explanation: the file is built in standard TIFF format (technically TIFF-EP) but given a* .NEF *file extension, and starts with tags for EXIF header information and white balance tables, then a thumbnail image (in JPEG BASIC format), and finally the raw pixel data stored in a simple left-to-right, top-to-bottom format.*

If you're a programmer, you might want to examine the C code that can be found at: http://www.cybercom.net/~dcoffin/ --it's the same code that's formed the basis of Bibble, Photoshop, and other converters. While at first this looks like it only refers to Canon raw files, the code indeed has Nikon NEF support embedded in it, including compressed NEF files.
If you're just curious about how software converts the Bayer pattern data into RGB data, send your browser to http://scien.stanford.edu/class/psych221/projects/99/tingchen/index.htm, which contains a much-cited dissertation on various methods that can be used.

Since I know you're curious, a simple demosaic routine for the D80 might work something like this (warning, geek speak ahead):

- Decompress the sensor data.
- Convert all data for the green positions into luminance values (Y).
- Obtain luminance values (Y) for red and blue positions by averaging/interpolating the data values for adjacent green positions.
- Calculate the color channels for the red and blue positions: Cr = R – Y while Cb = B – Y.

- Obtain Cr and Cb values for the positions that don't yet have them by averaging/interpolating the adjacent values.
- Obtain RGB data from the Y Cr Cb [55] data: R = Y + Cr, B = Y + Cb, and G = 0.2R + 0.7G + 0.1B.

Many other demosaic routines exist; the one just given is one of the simplest (especially if you use "averaging" instead of "interpolating" for the missing data[56]). Thus, each software product that understands the NEF file format tends to perform the interpretation of the photosite data slightly differently (and at different speeds!).

If you open an NEF file with Bibble, Photoshop CS2, and Nikon Capture NX side by side, you will see subtle differences in rendering of color and detail. If you're getting the idea that it might be worthwhile to sample all the NEF converters, you're right. Fortunately, most have trial versions available. I'll deal with this more in "D80-related Software" on page <604>.)

NEF files are larger than JPEGs:

D80 File Sizes

Format	*Large*	*Medium*	*Small*
JPEG fine	4.8MB	2.7MB	1.2MB
JPEG normal	2.4MB	1.3MB	600KB
JPEG basic	1.2MB	700KB	300KB
Compressed NEF	12.4MB		

For NEF+JPEG just add the appropriate NEF and JPEG figures together. File sizes are approximate due to compression effects and also sector size differences.

[55]Geeks will have already guessed that this is essentially CIE Lab Color space, the grandfather of all color processing definitions. You can write demosaicing routines for just about any color space you'd care to define, but most that I know of stick to Lab Color, RGB, and CYM(k).

[56]Okay, we're in footnote hell. An *interpolation routine* generally tries to do more than just average two adjacent data points. Complex interpolations examine a matrix of adjacent cells, usually a minimum of a 3 x 3 grid, but sometimes as wide as a 16 x 16 grid. Obviously, the smaller the grid, the faster the results are generated. But also, the smaller the grid, the cruder the results will be.

Compressed NEFs

The D80 creates only compressed NEF files. This compression is said by Nikon to be either "virtually lossless" or "visually lossless," meaning that results visually indistinguishable from the original data can be recovered. This isn't quite the same thing as "lossless," in which case the original data would be recovered exactly.

I'm not sure I'd term the methodology Nikon uses as "compression," but here's how it works: when photosite data comes off the ADC, it has 12 bits of value to it. A value of 0 would represent "no data" (black), a value of 4095 would represent "saturation" (white). If that was the way we stored the data, we'd need 12 bits to store each photosite's data. In order to reduce storage size, the way the D80 (and other Nikon bodies) "compress" NEF data is as follows:

- Shadow and low mid-range values are passed on as is.
- High mid-range and highlights values are split into groups (essentially, nearby values are rounded to another value). The manner in which this is done isn't linear. The last possible group value (almost white) has more adjacent values in it than the first (mid-range).

Thus, there are less than 4096 data values possible. These remaining values are now compressed using a somewhat traditional method that looks at adjacent differences and is truly lossless; the final data is packed across byte boundaries for space efficiency. The result is that the 12 bits of original data stores in about 9.5 bits[57].

To get back to 12 bits of data, a NEF converter such as Capture simply does the following: the adjacent differences are reversed (uncompressed) to get the data values back and the resulting 12-bit data is placed in 16-bit containers (computers like data with 8-bit boundaries).

[57] It appears that the value splits used in the D80 is slightly different than the compressed NEF formula used in earlier Nikon bodies. Instead of the 40-50% reduction in size generated by earlier Nikon DSLRs, the D80 only produces about a 20-25% reduction.

The problem, of course, is that there will now be "data gaps" that get progressively larger as we go higher in value—many original 12-bit values in the highlight range are essentially rounded to a different value, with the rounding being more aggressive as we move to brighter and brighter objects.

With a single trip through compression/decompression, D80 compressed NEF images are usually indistinguishable from what you'd see with no compression. Our eyes don't resolve the small differences that are made in the brightest areas of the photo. That's partly because our eyes work in a non-linear fashion with brightness (sensors are linear—the NEF compression scheme mimics our eye's non-linearity), but also because our eyes generally are thought to distinguish tonal changes only about equivalent to those produced by 8-bit RGB data. Even with the NEF compression scheme used in the D80, we still have the equivalent to more than 8-bits of original data. Since we almost always reduce 12-bit data down to 8-bits for printing, anyway, the minor tonal loss that compressed NEFs introduce into highlights isn't usually a big deal.

There is a slight possibility that the data loss introduced by NEF compression will show up in some way, though. Such changes would appear mostly in the highlight detail, and only if you made very dramatic post-processing changes (abnormally high sharpening amounts, lots of color shift, etc.).

Why NEF?

Why would you want to use NEF files?

If you have software that can understand this format, you'll get a more consistent tonal range in your images than with JPEG images and more subtle and accurate colors. Using 12 bits to record color data instead of 8 bits makes gradual (non-edge) transitions look smoother and subtler, even with the data loss due to compression. You'll also get a slight bit more detail than with JPEG images (resolution chart numbers are about 4% higher on average in my testing).

Post-processing exposure changes are also more easily made with NEF files (these are not really exposure changes, but changing of the linearity[58] of the exposure, which is why it works better to correct underexposed images instead of overexposed ones, though note that underexposure definitely brings up more noise on a D80, so the amount of correction range you have will be dependent upon your tolerance for noise). You also gain full *post-shooting* control over color correction and white balance decisions (with JPEG those decisions are irrevocably recorded in the data when the picture is taken). And, as just noted, you can usually "correct" slightly incorrect exposures.

With JPEG images, you're working from the camera's interpolation of the color and white balance. While you can often rebalance images using a program like Photoshop, you're one step removed from the original information—in digital media, each interpolation of original data can result in lost data or changes to data. The more changes you make, the more likely that artifacts of those changes become visible.

Tip: *If storage space isn't a consideration, strongly consider shooting in one of the image qualities that saves both NEF and JPEG files for each image. This gives you the best of both worlds. If image space* is *a consideration, remember that every NEF file embeds a JPEG Normal image in it that can be extracted, if necessary.*

[58]You may wonder what "changing the linearity" means. Normally, each rise in bit value represents an equal corresponding rise in "brightness." As shot, images have input-to-output relationship that is almost a straight line from 0,0 on a graph to 255,255 (you may have seen such a line in Capture or Photoshop's Curves tool). An increase of 16 on the Y axis is equal to an increase of 16 on the X axis. We can actually change this straight line to a steeper or shallower straight line, a curved one, or an even more complex relationship. When we change the linearity, we change the relationship between the X and Y axis. Instead of a data increase on the Y axis of, say, 16 being output as a value 16 higher on the X axis, we might lower that number (e.g. an increase of 16 on Y is output as an increase of 8 on X) or raise it (e.g. an increase of 16 on Y is output as an increase of 32 on X).

The NEF White Balance Controversy

If you've spent any time on the Internet researching the D2xs, you're likely to have seen comments about the encryption of the white balance value in D2xs NEF files, including those in my review of the camera (which can be found at http://www.bythom.com/d2xreview.htm). Cameras subsequent to the D2xs (the D50, D80, and D200 as I write this), use the same white balance encryption technique, so the same comments apply.

To reiterate the problem: camera settings are stored in EXIF tags for all NEF files and are not initially applied to the data (well, okay, the embedded JPEG image used for thumbnails and previews has the camera settings applied, but the raw camera data isn't messed with). In theory, you can simply pick new camera settings while looking at your image in a NEF converter program such as Nikon Capture NX and have them applied to the original sensor data. White balance is one such camera setting.

Nikon has been doing something strange with white balance values, though. There are two types of EXIF tags: those defined by a standard and in common use amongst all camera makers, and what's known as Manufacturer's tags—tags defined by a specific manufacturer. White balance should be in the common use tags. Nikon some time ago began splitting it out into the Manufacturer's tags of their NEF files. The result was that software that looked in the common tags for image data didn't find any information about white balance for Nikon NEF images. That meant special programming to deal with the Nikon images, but most programs that deal with white balance in any way (reporting or manipulating it) now understand Nikon's special white balance tags.

The original D2x introduced yet another wrinkle, however. Not only was the white balance information split out into the Manufacturer's tags, but it was now encrypted. Essentially, the camera serial number and shot number are one set of keys, and a constant serves as a hidden key. The camera serial number and shot number are visible to anyone, but the

constant and the actual white balance data tables are hidden within Nikon Capture NX (or the Nikon SDK files).

Encrypting shot data had implications for third-party software. Officially, Nikon's position was that third-party software should use the Nikon SDK (freely available under license agreement) to access NEF file data. Unfortunately, that had a number of further implications, not the least of which is that performance of any raw conversion was therefore dependent upon Nikon's programming efforts. (The SDK files are apparently not "threaded," meaning that they don't support background processing, which many imaging programs use to do multiple things simultaneously and increase performance.)

Initially, Adobe did not support the D2x white balance values in NEF files converted through the ACR function (raw converter) of Adobe Photoshop CS2. That's because they couldn't use the SDK as is, and they didn't want to decrypt the data as that might be construed as a violation of the Digital Millennium Copyright Act.

The net result was that for a short period of time we didn't have a full complement of optimal D2x NEF converters available, and it appeared that subsequent Nikon bodies that used this same technique wouldn't be supported, either.

Eventually, Nikon produced what they call the mini-SDK, which allows a developer to query for the white balance data only. Adobe and others have now used this in their software programs and thus support the D2x, D2xs, D50, D80, and D200.

The only benefit of white balance encryption is that it slows down other converter and software developers from fully supporting the Nikon cameras. This is certainly not a benefit to D80 purchasers as it slows down software development (once again there was a slight delay in Adobe supporting the D80, as Nikon first needed to provide them with an updated mini-SDK). Indeed, it means that software engineers working on converters have to spend time trying to figure out what

Nikon did rather than adding features to their converter. That's simply not a good use of their time.

But there's a bigger danger here: Nikon has abandoned software in the past (can you say Photo Secretary[59]?), and NEF images are our originals. Thus, there's the potential for the mini-SDK to go away at some future point in time.

Meanwhile, Adobe wants the camera makers to unite around an open format for raw images called DNG (Digital Negative). Most camera makers don't want Adobe to define their raw formats. The ironic thing is this: until Nikon decided to encrypt data in the NEF format, I was perfectly happy with the format and not worried about its longevity.

Already I'm shooting **RAW+Large JPEG fine** as a backup scenario. Beyond that, sometimes I use the latest DNG converter to convert my NEF images into DNG, though I don't do a lot of that because it further increases my image storage requirements, and I already have two terabytes of space hanging off my server.

The type of user that purchases the D80 isn't likely to be as concerned about white balance encryption as a D2xs user, as the D80 user is much more likely to just shoot in JPEG and be satisfied with whatever NEF solution Nikon gives them. Thus, white balance encryption isn't a big issue, just one you should be aware of.

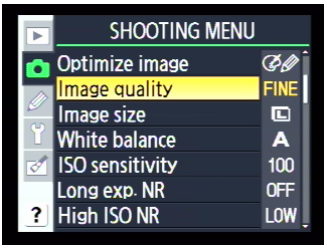
You might also want to check out the non-profit organization that has sprung up partly as a result of Nikon's decision: http://www.openraw.org.

[59]Photo Secretary was an image data program that Nikon created for the F100 and F5, which is no longer available. Meanwhile, Canon has dropped support for some early digital cameras in their latest versions of Canon conversion software, something that we Nikon users have to fear in the future, too.

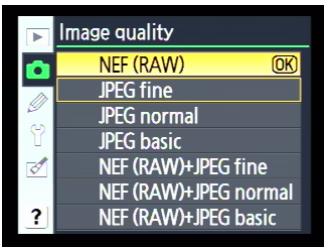
Setting NEF

To set the camera to record NEF images:

1. Press the **MENU** key to show the menu system.
2. Use the Direction pad to navigate to the SHOOTING menu (the green camera icon tab).
3. Use the Direction pad to navigate to the **Image quality** option and press ▸ key on the Direction pad or the **OK** button to select it.



4. Use the Direction pad to navigate to the **NEF (RAW)** option and press the ▸ key on the Direction pad or the **OK** button to select it.



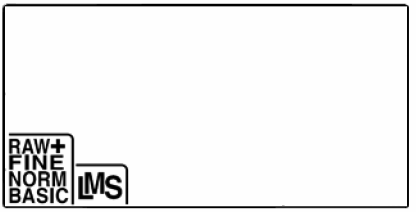
Note: *You can also choose to save both NEF and JPEG images simultaneously on the D80, which gives you the best of both worlds: the "digital negative" of the NEF and an immediately usable JPEG for simplified workflow. The D80 allows you to choose the JPEG quality level that's saved with the NEF, so you get choices of* **NEF(RAW)+JPEG fine**, **NEF(RAW)+JPEG normal**, *and* **NEF(RAW)+JPEG basic**.

Tip: *A JPEG image (in basic quality) is already stored along with the NEF image! It's embedded as the preview image. Software exists that let's you extract this JPEG (see* http://drchung.new21.net/previewextractor/ *for Windows*

users, look for a program called File Juicer if you use a Mac), so the NEF+JPEG choices are a bit redundant. Too bad Nikon didn't think to have an option for Extract JPEG during download of NEFs from camera to computer.

Alternatively, hold down the **QUAL** button on the back of the camera and rotate the Rear Command dial to select **RAW** (or one of the **RAW+JPEG** options; the top LCD displays the Image Quality setting as you change it):

Top LCD (only one option will appear at any given time; the **LMS** *indicators only appear if you've selected a RAW+JPEG option):*



Note that you don't normally set the **Image size** when you select **NEF (RAW)** format, as the D200 always records the full 3872 x 2592 image size for NEF files. However, if you elect to record a JPEG image along with your NEF, you *can* set the size of the JPEG image that's recorded using **Image size** (or the Front Command dial with the **QUAL** button).

EXIF

Even if you're a seasoned computer graphics pro, you may be surprised to find that JPEG and NEF files contain more than the image data. This extra information about the photo is sometimes referred to as *metadata*.

Nikon D80 cameras follow a standard developed by the JEIDA (a Japanese standards body), sometimes referred to as EXIF. The current standard version is EXIF 2.21, and is supported by the D80.

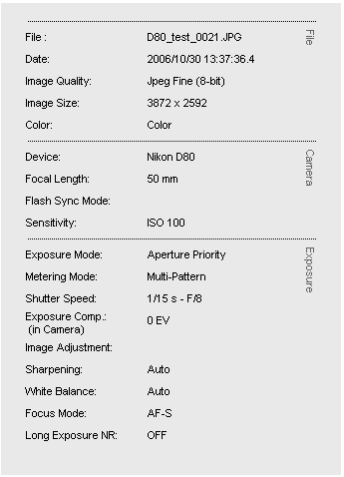
The additional data EXIF tags attach to an image includes:

- The name of the camera maker (Nikon).
- Camera model (D80).
- The camera's firmware version number.
- Information about the exposure itself: shutter speed, aperture, exposure mode, ISO value, date/time, overall brightness of scene (EV), exposure compensation, focus distance, metering mode, flash mode, focal length, and even the average compression ratio.
- Thumbnail image.

If you're interested in the esoteric inner workings of your D80, a fuller description of the EXIF file format is available at http://www.exif.org/Exif2-2.PDF. Note that just understanding the EXIF tags isn't enough—programs must also know what each of the values each manufacturer assigns means. Bibble, DigitalPro, Photoshop CS2, Nikon View Pro, and Nikon Capture NX all can display EXIF data and understand Nikon's values[60] (see "D80-related Software" on page <604>). Some programs may not fully display all the EXIF data values, though.

Not only is looking at EXIF data fun for the merely curious, but if you study the information closely, you may even learn about the idiosyncrasies of your camera and your shooting practices.

[60]Well, as I point out in "The NEF White Balance Controversy" on page <143>, not every program understands Nikon's encrypted white balance tag.



Here's the EXIF (Camera Settings) pane as it appears in Nikon Capture NX. Note how all the most important exposure data is shown, as is information about a number of camera settings.

EXIF is one of the reasons why you can't create or edit a JPEG file on your computer, save it back to the camera, and then see it on the camera's LCD, by the way. When you perform any **Save** or **Update** action on your computer, some of the EXIF tags in the file get modified (or removed) in ways that the D80 detects. This is too bad, as it prevents you from editing a series of JPEG files on your computer, then moving them to the camera for playback as a slide show. (In theory, if you replaced the EXIF tag with the correct, camera-consistent information, and didn't edit the thumbnail, you might be able to display edited pictures on the D80. In practice, I don't know of anyone who's successfully doing this.)

Note: For a program to display the correct EXIF information for an image, it has to know something about the camera and the codes that are stored in the EXIF tags (e.g. "18-70mm F/3.5-4.5" isn't stored in the lens field, but is instead stored as a short code that is unique to this lens). Now that the Nikon DSLRs have firmly established themselves (and because Nikon used consistent codes for many of the manufacturer functions in the various digital SLR models), most software applications correctly identify most D80 EXIF data. However, if you find the program you're using doesn't, check to make sure that you're using the latest version. If

you are, suggest to the developer that they contact Nikon for the EXIF codes for Nikon cameras. In theory, products that use Nikon's SDK should return correct EXIF data tags.

Unfortunately, as I've already pointed out, with the D80 Nikon has done something a bit sordid. The white balance setting used to be stored as a value in one of the Manufacturer's Tags, which are defined by the camera maker. Previous to the D2x, the values in this tag were open and understandable. Beginning with the D2x, and now including the D2xs, D50, D80, and D200, the white balance tag is encrypted, which makes it difficult for third party software to support that value.

Note: *Older EXIF specifications define the color space of* all *digital images as being sRGB, and a number of digital editing programs, including earlier versions of Photoshop (but not CS or CS2), assume that sRGB is the color space of any JPEG file that is opened and has EXIF data. The current EXIF definition has a special way of dealing with color space: the file is named differently for AdobeRGB color space: instead of* DSC_####.JPG *the file would be named* _DSC####.JPG*. This is implemented in the D80 firmware. Some programs you use may not recognize the color space if they haven't been updated to support the new standard.* *See "Color Profiles, Color Spaces, and Color Modes" on page <522> for more information on this subject.*

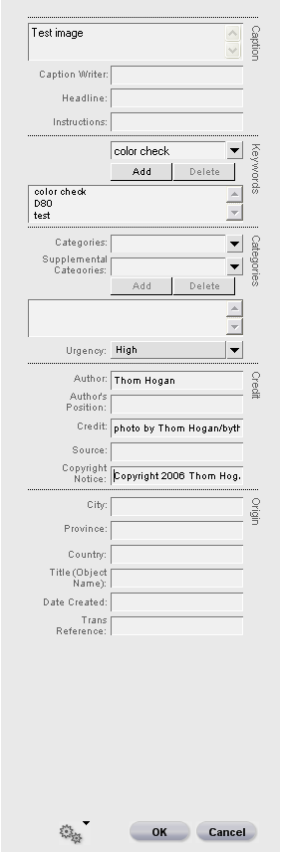
IPTC

Another type of metadata is sometimes incorrectly referred to as IPTC (International Press Telecommunications Council). IPTC is an organization, and the standard they've developed for common digital photo metadata is DNPR (Digital Newsphoto Parameter Record).

Like EXIF data, the DNPR metadata is stored in the photo file. A DNPR-aware program is required to show and edit the DNPR metadata (again, it's often referred to as IPTC data by many programs). If you shoot photos for news organizations, you need to be aware of this data and have some way of entering it, as most publications require it to be in place with photo submissions—it's become the primary method by

which news organizations track captions and photographer credits. IPTC has defined a common set of coding guidelines, but you should also check with the publication you're working with, as they may have their own specific standards, as well.

Though the D80 doesn't create any IPTC metadata, some third-party software programs allow you to add it to your D80 files. Nikon View's image transfer function has a setting that allows you to copy EXIF data into the IPTC fields, which I recommend using if you use that product. Here's what the IPTC pane in Nikon Capture NX looks like:



Note how I've identified both my Copyright and how I want the credit for the photo to appear. Also, I've keyworded the

image so that I can find it quicker with products that search IPTC keywords.

To find out more about IPTC, go to the organization's Web site, http://www.iptc.org.

DPOF and PictBridge

The D80 supports DPOF information in the image files. DPOF stands for Digital Print Order Format and was developed by Canon, Kodak, Fuji, and Matshushita to allow Secure Digital cards (or other storage cards) to contain information that automatically instructs a printer (or photo finishing machine). Amongst other capabilities, DPOF-capable cameras can specify:

- Which photos to print.
- How many copies of each photo to print.
- Whether or not to print a thumbnail index of all the images.
- Whether photos should be rotated.
- User information (name, address, etc.).
- Picture information (title, description, date, etc.).

You select the pictures to print on your D80 by adding them to a Print Set (see "Printing Your Images" on page <578>). When you remove the Secure Digital card from your D80 that has a defined Print Set and insert it into a DPOF-capable printer, such as the Epson Photo 875, the printer automatically prints out all the photos you've selected.

PictBridge is related to DPOF. Think of DPOF as the print data embedded in the image file and PictBridge as a communications protocol to transmit files from camera to printer. The D80 supports PictBridge, so you can connect a printer directly to the D80 and print from the storage card in the camera (see "PictBridge Printing" on page <582>).

If you're confused about why I just covered DPOF in the Image Formats section of the book, remember that DPOF is a set of standardized information that is stored *in* the image file.

File Names and Folders

The D80 follows an industry standard practice for putting images on portable storage media (Design Rule for Camera File Systems, sometimes referred to by the abbreviation DCF; the 1.0 standard is published at http://www.exif.org/dcf.PDF). Unfortunately, the designers of this format didn't make it particularly friendly. Likewise, many of the standards digital cameras follow are interwoven. DCF is related to the EXIF specification, for example.

Essentially, the standards committees put together by the early digital camera manufacturers were trying to put together a set of rules that made it easier to interchange data and connect devices. So while the standards seem arcane and confusing, remember they're actually there to make the user experience simpler.

Folders

Images are stored in folders on your Secure Digital storage card. The top-level folder for a digital camera is *always* named DCIM (Digital Camera Images). Actual image storage occurs in the structure underneath this folder. Within the DCIM folder, digital cameras place one or more additional folders. Each folder can have up to 999 images in it.

If you use multiple cameras, you will find multiple folders under the DCIM folder, thus you need to know how your cameras name folders:

For cameras that use Secure Digital cards:

Camera	Folder Name	Example
D50	###NCD50	100NCD50
D80	###NCD80	100NCD80
Coolpix	###NIKON[61]	100NIKON

For cameras that use CompactFlash cards:

D70	###NCD70	100NCD70
D70s	###ND70S	100ND70S
D2x	###NCD2X	100NCD2X
D2xs	###ND2XS	100ND2XS
D2h	###NCD2H	100NCD2H
D2hs	###ND2HS	100ND2HS
D100	###ND100	100ND100
D200	###ND200	100ND200
D1h	###NCD1H	100NCD1H
D1x	###NCD1X	100NCD1X
Coolpix	###NIKON	100NIKON

Note: There's a pattern in the folder naming: the first three characters are a numeric value that starts at 100 *and goes as high as* 999*; the next five characters indicate the camera maker and model. Usually Nikon uses the first two to indicate that this is a Nikon Camera (*NC*) and the final three characters indicate the type of camera that created the folder (*D80*). But not always.*

If you move a card between two different camera types, each will create an appropriate folder name under the DCIM folder! And each camera won't deal with the images already on the card from another camera. Short of doing a complete card format, you won't be able to remove a Coolpix folder that has images in it using a D80.

[61] As with the D50 and D70 series, on some Coolpix models you can rename the lettered portion of the name.

Other pitfalls occur with multiple cameras, too. Notice that three-digit number? If one of your D80's is set to use a folder named 145NCD80, then if you take that card out of that camera and put it into your other D80 and do something that triggers creation of a new folder, the number for the folder on the second D80 will be incremented to one higher than what the first D80 was using.

Another problem to watch for: if you have multiple folders on a card, the D80 will use the highest numbered one. Okay, it's a little subtler than that: images are saved into the currently selected folder *name* with the highest number.

On the D80, Nikon names the first folder the camera creates 100NCD80, the second 101NCD80, and so on. Unlike some earlier Nikon bodies, we now have the ability to override those last five characters of the folder names (i.e., the three digit number is always assigned by the camera).

If you want, you can use the menu system to change your folder name from 100NCD80 to 100BYTHM. (Note that the folder number stays the same; we change only the last five characters.) I'll get to how you make those changes in a moment.

First, I want to enumerate all the things you can do with folders. The D80 allows you to do four things with folders:

- Select from existing folders
- Create a new folder
- Rename an existing folder
- Delete *all empty* folders.

Before I tell you how to do those things, here's my recommendation: don't. Consider that recommendation

boldfaced and italicized if you use multiple digital cameras using the same set of Secure Digital cards[62]. ***Don't***.

Astute readers have noticed my use of the words "pitfall" and "problem" in relation to folders. The classic worst case scenario is this: you use multiple folders to capture images, download the images from only one folder (perhaps because you used a drag and drop method from card to computer instead of using Nikon PictureProject's transfer function), then reformat the card. Goodbye images. I've learned the hard way not to get too creative with folders—indeed, if I were to rename them from the base names, I wouldn't know which folder was created by which camera unless I was paying careful attention in my naming practices.

Okay, you've been warned. Should you choose to play with fire, uh, I mean folders, keep reading.

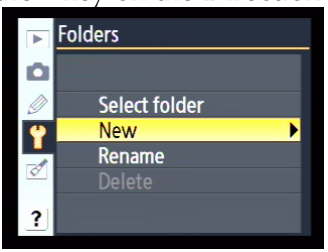
To create a new folder:

1. Use the Direction pad to navigate to the SET UP menu (the yellow wrench icon tab).
2. Use the Direction pad to navigate to **Folders** and press the ▸ key on the Direction pad or press the **OK**

[62] I can think of one legitimate reason to start renaming folders: you own multiple D80 bodies and want to track which images came from which camera. Newspapers and other organizations that use "pool cameras" often rename folders so that they can track which images came from which photographer; this also helps them to backtrack if they find that they're seeing problems with images from one camera. The D80 provides a better facility for that, though: the **Image Comment** field (see "Programming a Comment" on page <186>). Since this field follows the image around regardless of the folder or file name, you could track what camera produced the image by simply looking at that value. So I'll stick by my recommendation: stay away from the folder options.

button to select this option.

3. Use the Direction pad to navigate to **New** and press the ▸ key on the Direction pad or press the **OK** button.



4. In the display that appears, enter the five-character name:

   a. Use the Direction pad to navigate to a letter or number (highlighted in yellow).

   b. Press the **QUAL** (🔍) button to select that letter or number.

   c. If you need to move the cursor position, hold down the **ISO** button (🔍+▦) and press the Direction pad to move the cursor to the appropriate position.

   d. To delete the current character, press the 🗑 button.

5. When done entering your five-character name, press the **OK** button to complete the entry.

Note new setting on right

To abort the new folder creation process, press the **MENU** button at any time prior to the last step.

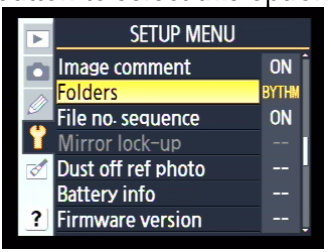
New folders are created automatically by the camera when:

- The number of images in the current folder reaches 999. A new folder is created and images begin being stored in that new folder. (That's because there's a limit to 999 files in a folder in some of the real-time operating systems cameras use.)
- The last filename stored ended in **9999**. A new folder is created and images starting with **0001** begin being stored in that new folder. (That's to avoid any possibility of a new file overwriting an existing one.)
- Sometimes when you "touch" the card format or data with something other than a camera or other DCF device (e.g., you put the card into a PC and edit a file on the card). (That's because the camera sees that something has changed in the file structure on the card and it creates a new folder and starts storing images there to be safe.)

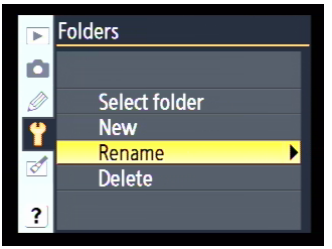
To rename an existing folder:

1. Use the Direction pad to navigate to the SET UP menu (the yellow wrench icon tab).
2. Use the Direction pad to navigate to **Folders** and press the ▸ key on the Direction pad or press the **OK**

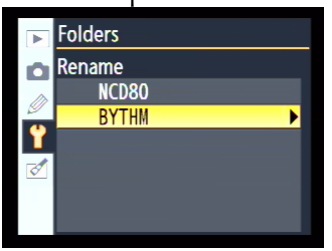
button to select this option.



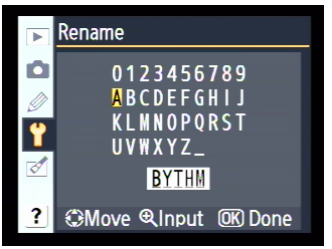
3. Use the Direction pad to navigate to **Rename** and press the ▸ key on the Direction pad or press the **OK** button.



4. Use the Direction pad to navigate to the name of the folder you wish to rename and press the ▸ key on the Direction pad.



5. In the display that appears, enter the new five-character name:



a. Use the Direction pad to navigate to a letter or number (highlighted in yellow).

b. Press the **QUAL** button (🔍) to select that letter or number.

c. If you need to move the cursor position, hold down the **ISO** button (🔍▦) and use the Direction pad to move the cursor to the appropriate position.

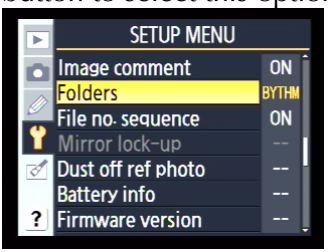
d. To delete the current character, press the 🗑 button.

6. When done entering your five-character name, press the **OK** button.

To abort the new folder renaming process, press the **MENU** button at any time prior to the last step.

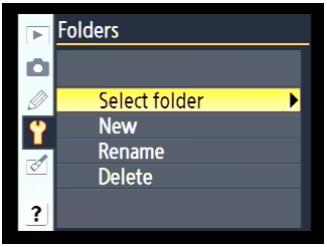
📷 To select a different folder from the current one:

1. Use the Direction pad to navigate to the SET UP menu (the yellow wrench icon tab).
2. Use the Direction pad to navigate to **Folders** and press the ▸ key on the Direction pad or press the **OK** button to select this option.

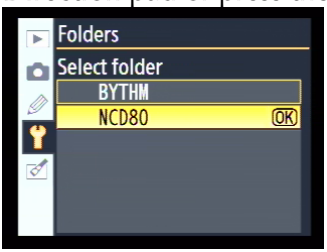


3. Use the Direction pad to navigate to **Select folder** and press the ▸ key on the Direction pad or press the

OK button.



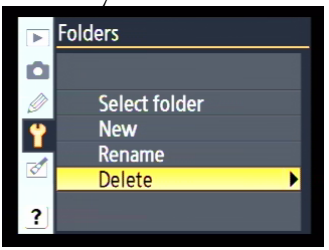
4. Use the Direction pad to navigate to the name of the folder you wish to use and press the ▸ key on the Direction pad or press the **OK** button.



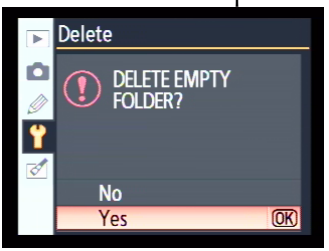
📷 To delete all folders that have no images in them (including the current folder, if it meets the criteria!):

1. Use the Direction pad to navigate to the SET UP menu (the yellow wrench icon tab).
2. Use the Direction pad to navigate to **Folders** and press the ▸ key on the Direction pad or press the **OK** button to select this option.

3. Use the Direction pad to navigate to **Delete** and press the ▸ key on the Direction pad or press the **OK** button.



4. Use the Direction pad to navigate to **Yes**.



5. Press the **OK** button to complete the deletion process.

Note: If you delete the current folder it may still show up in the menus after you've deleted it, at least until you select another folder in which to store images.

To abort the folder deletion process, press the **MENU** button at any time prior to the last step.

Should you ever get to a folder name that is numbered 999 *and* a filename that contains the number 9999 or is the 999th file in the current folder, the D80 will lock up and refuse to take a photograph. In this situation you must:

1. Make sure you've transferred all your images off the card to your computer (see "Connecting to a Computer" on page <575>).
2. Set **File no. sequence** to **Off** (see "File Numbering Sequence" on page <169>).
3. Set **File no. sequence** to **Reset**. (Theoretically, you don't need to do this, but it appears that this step is required in some cases.)

4. Format the storage card (see "Formatting Cards with the Camera" on page <115>). (Or insert a new storage card.)
5. Set **File no. sequence** back to **On**. (I'm assuming that you've followed my other instructions and set this option to **On** in the first place.)

File Names

Individual files are normally named DSC_####.XYZ, where #### is a sequential image number and "XYZ" is replaced by the appropriate three-letter file format extension (e.g. JPG, TIF, or NEF). (The DSC stands for Digital Still Camera, by the way; some digital cameras can create movies, hence the three-letter usage). Thus after you've taken a few pictures on a Secure Digital card, the structure looks like this:

```
DCIM
+---100NCD80
        +---DSC_0001.JPG
            DSC_0002.JPG
            DSC_0003.JPG
            Etc.
```

The folder name and filename are displayed on the top line at the bottom left corner of the Color LCD when you review images (assuming you're on the main review page):

In this example, the folder name is 100NCD80 and the filename is DSC_0221.JPG. (The position of the _ in the filename indicates that the Color Space the camera was set to.

See "Color Profiles, Color Spaces, and Color Modes" on page <522>.)

Note: When I shoot with both a Fuji S3 Pro and a Nikon D80, I can immediately tell which images came from which camera: the Fuji uses an **F** *instead of _ in their filenames (e.g.* DSCF0001.JPG*). If you use more than one digital camera, do yourself a favor and note the different folder and file naming conventions of the two cameras. Some day you'll be glad you did.*

The D80 does not allow you to rename the "DSC" portion of the filename as do Nikon's more advanced cameras (D200, D2hs, and D2xs).

Because the D80 doesn't provide any options for file names, you need to develop a discipline in moving images from the camera to your computer. If you don't, you'll end up with hundreds, perhaps thousands, of image files that have nothing else to distinguish them than a four digit number (and, of course, if you get to the tens of thousands, you're going to have duplicate file names).

Nikon PictureProject, as well a growing number of third party programs, allows you to automatically transfer files from camera (or storage card in a card reader) to the computer with a renaming scheme of your own choosing (e.g. copy DSC_0001.JPG to PhillyzooApril001.JPG, DSC_0002.JPG to PhillyzooApril002.JPG, etc.). Other programs allow you to rename files once transferred (even Photoshop CS2 has decent renaming capabilities, for example.) If you use one of these programs, I suggest you do the following:

1. Leave the default folder intact on your D80. While you can create and name folders and move between them, capturing some images in one folder, some in

another, etc., this can get confusing in practice[63]. If you need to organize images as you shoot, it's probably better to use multiple Secure Digital cards, though you'll need to be careful in labeling them.

For example, if in the morning you shot at the zoo, then in the afternoon went to a museum to shoot, save your zoo photos on one Secure Digital card. Then, before starting to shoot at the museum, take that card out and put in a new one. (If your memory is like mine, you probably ought to write this down and label your cards, just in case a few days pass before you can get the images off the Secure Digital card. The trick I use is to bring a bunch of small envelopes with me, and then I just put the card in the envelope, label the envelope, and seal it. Any sealed envelope I encounter obviously has a shot card in it.)

2. On your computer, create descriptive folder names that match the locales you shot in (e.g. in the example, I'd create folders named PhillyZooApril01 and MomaApril01 on my computer; I add the month and year to the folder name because I often revisit the same sites; also, these folders live in a folder hierarchy that helps me re-find them: e.g. US/PA/Philadelphia/PhillyZoo/PhillyZooApril01).
3. Put each Secure Digital card you shot into your computer's card reader and use a renaming-capable program like Nikon PictureProject's transfer function to move images from the card to your computer[64].

[63]I think the primary reason most users change folder names is to distinguish between multiple cameras, but I'd argue the **Image comment** field is a better place to do this, as the information stays with the images.

[64]One nice thing about Nikon PictureProject's transfer renaming is that it correctly assigns the same name to both files when you shoot **NEF+JPEG BASIC**. Thus, you end up with file names such as PhillyZoo_0001.JPG and PhillyZoo_0001.NEF. One bad thing about Nikon's transfer functions is that they always place both files in the same folder (Photo Mechanic allows you to place them in different folders). I prefer having my preview files (JPEGs) in a different folder than my "negatives" (NEFs). Macintosh users have an answer, though: download the SeparateJPEGs Automator action from the Apple Web site.

Recent versions of PictureProject do this reliably and quickly on both Macs and PCs.

Some Nikon shooters swear by other software that supports direct transfers, such as DigitalPro, Photo Mechanic, Breezebrowser, or Image Ingester. The key is you really need to use a program that'll rename files *during* the transfer. If you merely use an operating system copy from card to computer, you can't easily automate the renaming of the files as they're copied, which I highly recommend. The reason you want to rename: eventually you'll take more than 9999 photos and you'll end up with duplicate file names that can confuse you and your computer. If you don't use Sequential File Numbering and also don't use file renaming during transfer, I'd say you're headed for a massive file naming confusion on your computer. I've seen one fellow's computer where he had *several dozen* files all named DSC_0001.JPG! Good luck finding the right image, buddy.

4. If any of the files you copied in Step 3 are JPEG files[65], you should also consider immediately using a product that'll resave them in a form without compression (you can set up a Photoshop Action, for example, to take all the files in a folder and save a .TIF or .PSD version for editing). If you don't perform this step, then you'll need to be attentive when you open files for manipulation, since some software applies JPEG compression *every* time you save a file in the JPEG format (i.e. you could end up compressing previously compressed files, adding artifacts). Fortunately, Photoshop versions 6.0 and later don't do that, but beware of touching your JPEG files with other products. (Note also that some programs can perform image rotation without recompressing JPEG images, and some don't. I find it safer to avoid the problem

[65]If you're shooting **NEF+JPEG** you can safely ignore this advice, as you have a NEF file that isn't affected in this way.

entirely by moving my files out of JPEG format as soon as possible, even before rotating them.)

5. After verifying that the files you copied in Step 3 are on your computer intact, put the Secure Digital card back in your camera and reformat it so that it is cleared of image files and ready for your next shooting session. If you delete individual files and leave folders instead of reformatting, you'll eventually end up with file fragmentation on the card, which reduces size and performance. Formatting is the only option that guarantees that the card is optimized for storing new data.

These steps are part of what is sometimes called "digital workflow," the consecutive actions you make on an image after taking that picture with the camera. The above steps are a simple form of workflow. I'll describe ways of automating the workflow in "D80-related Software" later in this eBook (see page <604>). What I've just described is about the minimum you should do with your image files.

While file names are generally created consecutively (e.g. DSC_0001.JPG, DSC_0002.JPG, etc.), a number of things *may*[66] cause the camera's numbering to reset:

- Creating a new folder (if File Numbering Sequence is turned OFF; see "File Numbering Sequence" on page <169>).
- Using the **File no. sequence** option on the SET UP menu to **Reset** the file numbers.
- Using the camera reset option (see "Resetting the Camera" on page <199>).
- Moving a Secure Digital card that already has images on it between different cameras.

[66]Other than the three items listed previously, a file numbering reset doesn't necessarily happen every time these other events occur.

- Writing to a Secure Digital card when it is mounted in a card reader attached to a PC.
- Removing the battery without first turning the power switch to the OFF position (same with power supplied to the **DC In** socket on the front of the camera).

Whatever the cause, you should see that having a camera reset the numbering is not a trivial event. If you develop bad habits that trigger frequent numbering resets, you could end up with a computer filled with images all numbered the same! I can't say this strongly enough: develop a discipline with your camera use and workflow so that you don't unintentionally trigger numbering resets, and rename your image files to meaningful names as soon as possible. It'll save you a lot of grief later.

Yes, Nikon's defaults and the D80's default behaviors make no sense in regards to file numbering. Some of that is the standard the D80 follows. Because the file structure of the Secure Digital card is the old DOS-style FAT, file names are limited to eight characters and a three letter extension[67], and because the standard takes up four (!) of those characters to designate that the file contains an image (hey guys, that's what the extension was for!), that didn't leave much for the camera manufacturers.

Did I say develop a discipline with your camera use and workflow loudly enough? Those of us who shoot tens of thousands of images a year for a living are forced to do so by the camera's behavior. Don't let losing an image be the catalyst for getting serious about file renaming on transfer. As Nike's slogan says: just do it!

[67]Even the Microsoft programmers found ways around this limitation in the days of DOS, by the way, so there really isn't any excuse for the standard to limit itself like this. As it is, I'm surprised an enterprising camera company hasn't figured out that they could use an EXIF tag to store long, meaningful file names and then have their transfer software simply substitute it for the short name when the file is moved!

File Numbering Sequence

The D80 allows you to specify when file numbers are reset. You have three choices:

- **Off**. File numbers are always started at 0001 whenever a new folder is created, when the storage card is formatted, or a new storage card is inserted into the camera.
- **On**. File numbers are incremented until they reach 9999, at which point a new folder will be created and the file numbering will begin again at 0001.
- **Reset**. The file number is reset to 1+the current file number in the current folder (if there are no images in the current folder, numbering is reset to 0001).

Of these options, **On** makes the most sense, and is the one I use on all my Nikon DSLRs. That's because file name duplication is dangerous—you could accidentally erase or overwrite a file you wanted to keep. If you leave the camera set to **Off**, you'll generate a new DSC_0001.JPG (or .TIF or .NEF) file every time you format the card and start shooting again.

See "Setting the File Numbering Sequence" on page <191> for how to set this option.

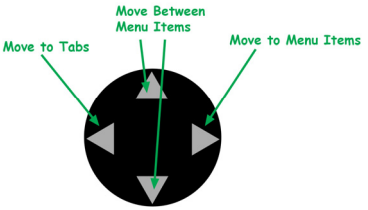
Camera Setup

Before using your D80, you need to make a few settings to establish some basic information the camera needs. In this chapter I'll introduce the SET UP *menu, then take you through a few of the things you ought to set the first time you use the camera.*

How Menus Work

Many of the D80 settings you'll want to make require navigating options displayed on the color LCD (see "D80 Color LCD" on page <212>. When you press the **MENU** button on the back of the camera, the color LCD displays a menu of selections to choose from.

Color LCD



Autofocus Direction Pad

The menu system consists of three elements: Tabs, Menu Items, and the Current Selections for the Menu Items. Tabs—also called menus—are grouped categories of *Menu Items*. The Tabs from top to bottom are:

Icon	*Menu Name*
Play button	PLAYBACK menu
Camera	SHOOTING menu

Pencil	CSM[68] menu
Wrench	SET UP menu
Brush	RETOUCH menu

Note: In this eBook, I'm consistent about always capitalizing the names of the menus (followed by the word "menu"). The camera uses capitalized menu names, too. I've elected not to capitalize the word "menu" the way the camera does, however.

One last thing that sometimes appears in the Tabs column is a question mark icon. This isn't a menu you can reach, but simply indicates that if you press the **?** button on the camera you can get help for the currently displayed Menu, Menu Item, or Setting. If the question mark icon doesn't appear, there is no help for the current point you're at in the menu system.

The menu options themselves lead to individual choices or sub-options. The entire system is simply a hierarchy of choices. For example:

Tab	*Main Choices*	*Sub-Choices*	*Additional Choices*
Camera ↘			
	Optimize Image ↘		
		Normal	
		Softer	
		Vivid	
		More Vivid	
		Portrait	
		Custom ↘	
			Done
			Image Sharpening
			Tone Compensation
			Color Mode
			Saturation
			Hue Adjustment

Put another way, to set **Image Sharpening**, you must navigate to the SHOOTING menu (camera tab), select

[68]Stands for Custom Settings Menu, which I guess makes this the CUSTOM SETTINGS MENU menu.

Optimize Image, then select **Custom**, then select **Image Sharpening**. To accomplish this navigation, you use the Direction pad (just to the right of color LCD) to move through the menu system:

- Use the ▲ and ▼ keys[69] on the Direction pad to navigate up and down between Menu Items, or up and down between Tabs. The currently selected Menu Item or Tab is highlighted in yellow.
- Use the ▶ key to move from the Tabs area to the Menu Item area, or to select the currently highlighted Menu Item.
- Use the ◀ key to move from the Menu Items area to the Tabs area at the left of the menu system display.

If there are sub-choices for any Menu Item, you again use the ▲ and ▼ keys to navigate up and down between choices, then use the ▶ key to select one.

The D80 displays **OK** at the end of an option to indicate that you should press the **OK** button to complete your selection[70]. If only a ▶ appears at the end of the Menu Item, that means that there are more choices in a sub-menu; you may press either the ▶ key on the Direction pad or the **OK** button to make your selections.

Before you move on, make sure that you understand how you navigate between menus (Tabs), and within menus (Menu Items). In practice, you'll find that you quickly adapt to using this navigation and selection method, but it does throw some first time users off, as the menus can be relatively deep (have lots of sub-items) at some points in the system.

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[69] While I refer to these as "keys," they aren't actually separate buttons, but merely sides of a bigger button, the Direction pad. If you look closely at the Direction pad you'll see little arrows engraved on it. So when I say press the ▶ key on the Direction pad, I mean press the Direction pad in the area labeled with the ▶ engraving.

[70] To be consistent with previous Nikon bodies, the D80 *usually* accepts pressing the ▶ key on the Direction pad, as well. However, this isn't universal, as some destructive actions require you to press the **OK** button only.

The SET UP Menu

The SET UP menu is where you go to change things that you rarely change on your camera, but need customization, such as the language the camera uses to display information.

To get to the SET UP menu, press the **MENU** button, then use the ▲ and ▼ keys on the Direction pad to navigate to the SET UP Tab (the wrench icon near the bottom left of the display—remember that you may have to use the ◀ key to get over to the Tab area first!). Press the ▶ key on the Direction pad to get to the individual options within the SET UP menu.

You'll see a short list of options[71]:

CSM/Setup menu

The D80 has three *types* of menus: **Simplified**, **Full**, and **My menu**. The camera comes with **Simplified** selected, which is a reduced set of menu items, but some options won't appear unless you change this setting to **Full**. You may also change the menu system so that the only options that appear are ones

[71] Nikon is up to their old tricks: they've changed the name of some items on the D80's menus from those on previous cameras. This really is silly and can be frustrating to users of multiple Nikon bodies. For example, on the older bodies and D2h we have **Date** while on the D2xs, D2hs, D80, and D200 we have **World time** for the function to set the clock. While it should be relatively obvious that it's the same function, Nikon's engineers need to learn that even these small changes can impair cognitive functioning and slow us down while our brains try to make sense of an unexpected difference. There are dozens of examples of these subtle changes, plus Nikon has changed capitalization in the names, as well (the D80 pretty consistently uses only initial-word caps, but some Nikon bodies capitalize all Menu Item words).

	you choose (**My menu**). See "Setting the Menu Options that are Visible" on page <176>
Format memory card	Wipes all information stored on the Secure Digital card (see "Using Secure Digital" on page <112>).
World time	Sets the date and time (see "Setting Date and Time" on page <180>).
LCD brightness	Sets the brightness of the color LCD on the back of the camera (see "Setting the LCD Brightness" on page <189>).
Video mode	Sets the video format (see "Television Playback " on page <591>).
Language	Sets the language used for the menus on the color LCD (see "Setting Language" on page <185>).
USB	Allows you to change the way the camera presents itself to the computer (either as a mass storage device [e.g. like a hard drive], or as a point-to-point device [e.g. like a peripheral that interacts with the computer]).
Image comment	Allows a comment to be appended to your image files (see "Programming a Comment" on page <186>.
Folders	Allows you to select, create, name, or delete folders (see "Folders" on page <153>).
File no. sequence	Allows you to select how the camera handles file naming (see

	"File Numbering Sequence" on page <169>).
Mirror lock-up	Enables the mirror to be locked up out of the way for sensor cleaning. This option is grayed out unless the camera is running off power connected to the **DC In** socket (e.g. the EH-6 AC Adapter) or has a full battery. See "Keeping the Sensor Clean" on page <538>.
Dust off ref photo	Allows you to take a dust removal reference photograph for use with Nikon Capture NX. See "Nikon Capture NX" on page <620>.
Battery info	Displays additional information about the battery status (and how many pictures you obtained with the battery). See "Battery Notes" on page <103>.
Firmware Version	Displays the current firmware version of the camera (see "Firmware Version" on page <201>).
Auto image rotation	Enables or disables the automatic image rotation sensor (see "Rotating Images" on page <380>).

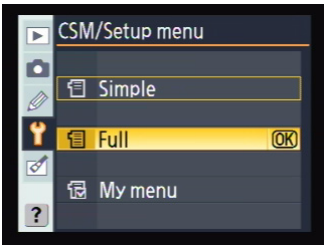
Despite the name "SET UP", not all of the items grouped on this menu are things that you do when you initially set up the camera. I'll tackle the items on this menu in the order and organization I think more appropriate. In this section of the eBook, we're simply looking to get the camera set up properly for shooting. Individual settings we might change in response to the scene we're photographing or other actions will be dealt with later (note the "see…" pointers after each item).

Setting the Menu Options that are Visible

First up, we need to get the menu system to show all of our options. You can go back to the **Simplified** view later if you'd like, but I want to show you all the options on the camera and how I think you should be setting them, and to do that we need the **Full** menu system active.

1. Turn the camera **ON**.
2. Press the **MENU** button to turn on the color LCD.
3. Use the Direction pad to navigate to the SET UP menu (the yellow wrench tab).
4. Use the Direction pad to navigate to the **CSM/SetUp menu** option. Press the ▸ key on the Direction pad or the **OK** button to select it.

5. Use the ▴ and ▾ keys on the Direction pad to set the **Full** value. Press the ▸ key on the Direction pad or the **OK** button to select it.



Note: This is probably a good time to point out some additional aspects of the menu system. Note that **Simple** *in the above screen shot is shown with a yellow box around it. The yellow box notation means that it is the* current *value the camera is using for the option. The inverted black-on-yellow*

for **Detailed** *followed with the* **OK** *indicates your new selection; if you press the* **OK** *button on the camera back and you'll make the inverted option the new current setting.*

The second thing to note is the icons that appear to the left of the words for each menu item. These icons are the ones that show up as the "currently selected value" for menu items when you're looking at the top level of the menu system.

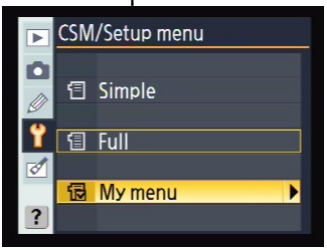
My initial recommendation is that you leave the camera set to **Full**. In the SET UP menu, all the additional items you just activated show up at the end of the menu item list, so shouldn't get in your way. On the Custom Settings menu (see "Custom Settings" on page <393>), the D80 also adds all the additionally enabled items to the end of the menu. Thus, you really don't make the camera any more difficult to use by setting **Full**.

After you've used your camera long enough to know which settings you use and set often, it might be worth using the **My menu** option to remove things that you never change (for example, most people never change the **Language** or **Video mode** settings on their camera after the initial setup). To do this:

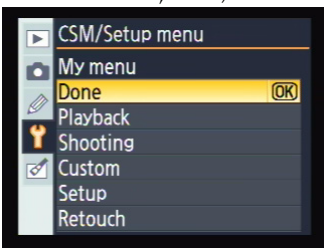
1. Turn the camera **ON**.
2. Press the **MENU** button to turn on the color LCD.
3. Use the Direction pad to navigate to the SET UP menu (the yellow wrench tab at the bottom left of the display).
4. Use the Direction pad to navigate to the **CSM/SetUp menu** option. Press the ▸ key on the Direction pad or

the **OK** button to select it.

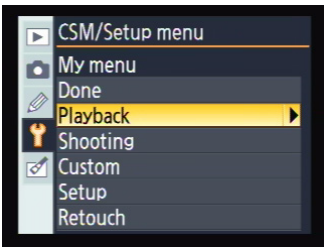
5. Use the ▲ and ▼ keys on the Direction pad to navigate to the **My menu** option and press the ▶ key on the Direction pad or the **OK** button to select it.



6. For each menu you wish to change (PLAYBACK, SHOOTING, etc.):

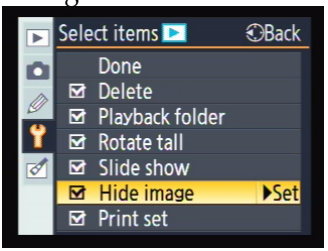


   a. Use the ▲ and ▼ keys on the Direction pad to select the menu you wish to change. Press the ▶ key on the Direction pad or the **OK** button to select it.



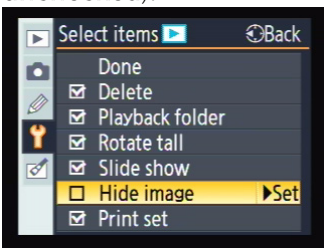
PLAYBACK menu chosen

i. Navigate to a Menu Item you wish to change.



Hide chosen

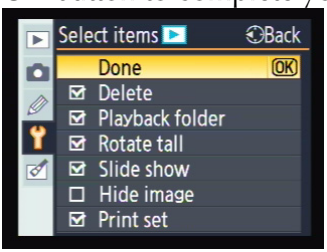
ii. Use the ▸ key on the Direction pad or the **OK** button to make it appear (box checked) or to make it invisible (box unchecked).



Hide removed

b. Use the ▴ and ▾ keys on the Direction pad to move to other Menu Items in the menu you'd like to change and repeat step 6a for each of them.

7. When you're done with all your choices, navigate to **Done** and press the ▸ key on the Direction pad or the **OK** button to complete your settings.



Here are my candidates for removal once you'd done your initial camera setup:

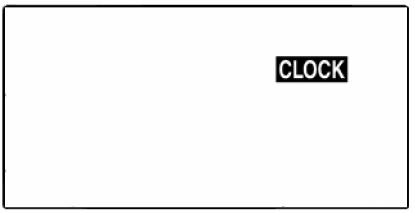
PLAYBACK menu: **Hide image** and **Print set**.
SHOOTING menu: none.
CSM menu: **Beep**, **No memory card?**, **Viewfinder warning**, **Center-weighted**, **Auto BKT set**, **Auto BKT order**, **Command dials**, **Flash warning**, and **MB-D80 batteries**.
SET UP menu: **Video mode**, **Language**, **USB**, **Folders**, **Auto image rotation**.
RETOUCH menu: none.

To get back the options that you removed with this function, you can reset the camera, use **My menu** again, or select **Full** for **CSM/Setup menu**.

Date, Time, and Language

As noted in the section on power, an internal battery powers a clock/calendar function within the D80. The clock/calendar is used to add information to the EXIF header about when a picture was taken.

Note: If the CLOCK icon is blinking near the upper right corner of the top LCD, then the internal battery ran low on power and the date and time were reset. Make sure that the camera is either on AC power or has a fully charged battery in it for the next three days in order to recharge the internal battery.



Setting Date and Time

Set the date and time using the following steps:

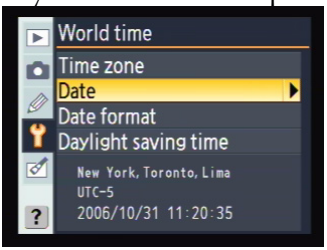
1. Press the **MENU** key to show the menu system.
2. Use the Direction pad to navigate to the **SET UP** tab (the wrench icon—you may have to use the ◀ key to get over to the tabs first!).

3. Use the Direction pad to navigate to the **World Time** option. Press the ▸ key on the Direction pad or the **OK** button to select it.

4. Use the Direction pad to navigate to **Time Zone**. Press the ▸ key on the Direction pad or the **OK** button to select it.

5. In the screen that appears, use the ◂ and ▸ keys on the Direction pad to place the highlighted area in your time zone (names appear at the top of the screen). Press the **OK** button to select the currently highlighted area.

6. Use the Direction pad to navigate to **Date**. Press the ▸ key on the Direction pad or the **OK** button to select it.



7. Use the ▴ and ▾ keys on the Direction pad to set the **Year** value. Press the ▸ key on the Direction pad or the **OK** button to move to the next field.

8. Use the ▴ and ▾ keys on the Direction pad to set the **Month** value. Press the ▸ key on the Direction pad or the **OK** button to move to the next field.

9. Use the ▴ and ▾ keys on the Direction pad to set the **Day** value. Press the ▸ key on the Direction pad or the

OK button to move to the next field.

10. Use the ▲ and ▼ keys on the Direction pad to set the **Hour** value. Press the ▶ key on the Direction pad or the **OK** button to move to the next field.

11. Use the ▲ and ▼ keys on the Direction pad to set the **Minute** value. Press the ▶ key on the Direction pad or the **OK** button to move to the next field.

12. Use the ▲ and ▼ keys on the Direction pad to set the **Second** value.

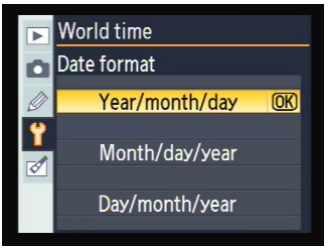
13. Press the **OK** button to save the data you just entered.

Note: If you pause for 20 seconds or more during Steps 6 through 13, the D80 automatically turns off and cancels any changes you've made up to that point. Alternatively, you can press the shutter release halfway (or more) during Steps 6 through 13 to cancel the operation.

You can also change the format in which the date appears:

14. Use the Direction pad to navigate to **Date Format**. Press the ▸ key on the Direction pad or the **OK** button to select it.

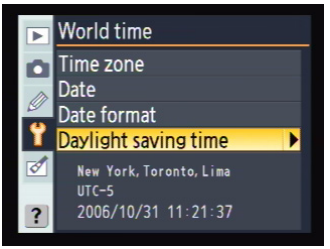
15. Use the Direction pad to navigate to your choice of formats and press the ▸ key on the Direction pad or the **OK** button to select it.



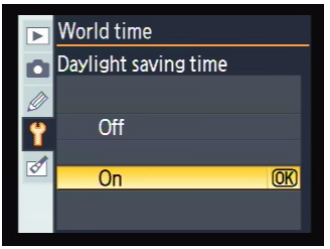
Finally, you can tell the camera whether Daylight saving time is active:

16. Use the Direction pad to navigate to **Daylight Saving Time**. Press the ▸ key on the Direction pad or the **OK**

button to select it.



17. Use the Direction pad to navigate to your choice of **On** or **Off** and press the ▸ key on the Direction pad or the **OK** button to select it.



Setting Language

The D80 can display menus on the color LCD in fourteen languages: Chinese (simplified or traditional), Dutch, English, Finnish, French, German, Italian, Japanese, Korean, Polish, Portuguese, Russian, Spanish, and Swedish. If you've purchased an official import of the D80 (i.e. not a gray market[72] model), it should already be set to the appropriate language.

If you'd like to change the camera's displayed language:

1. Press the **MENU** key to show the menu system.
2. Use the Direction pad to navigate to the SET UP menu (the wrench icon) and press the ▸ key on the Direction pad or the **OK** button to select it.

[72]Gray market products are those that are brought into a country by someone other than the official importer. Nikon's warranties generally only apply to officially imported cameras. In the US, especially, Nikon is particularly careful to only repair officially imported cameras.

3. Use the Direction pad to navigate to **Language** (the second item on the second page of options, and whose current value is shown as a two-letter abbreviation) and press the ▸ key on the Direction pad or the **OK** button to select it.

4. On the new menu that appears, use the Direction pad to navigate to the language you desire (the languages are in rough alphabetical order (if you use their International spelling)—German, English, Spanish, Finnish, French, Italian, Dutch, Polish, Portuguese, Russian, and Swedish, followed by the Asian languages. Press the **OK** button to lock in your choice.

Note: Changing the camera's language only applies to the menus displayed on the color LCD. Information displayed in the viewfinder and on the top LCD and viewfinder remains in Anglo-based icons.

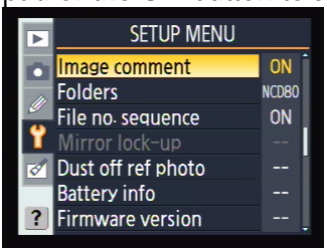
Programming a Comment

The D80 allows you to place a short comment in the EXIF data of every photograph you take. I suggest that you use it to enter a Copyright notice on your images:

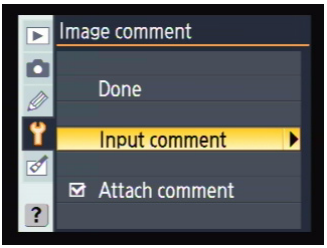
1. Press the **MENU** key to show the menu system.

2. Use the Direction pad to navigate to the SET UP menu (the wrench icon) and press the ▸ key on the direction pad to select it.

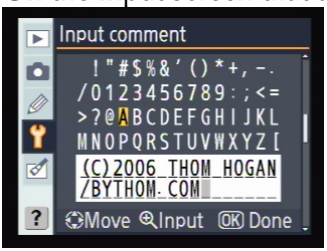
3. Use the Direction pad to navigate to **Image comment** (before you set it, the current value is shown as **–** rather than **ON**) and press the ▸ key on the Direction pad or the **OK** button to select it.



4. Use the Direction pad to navigate to **Input comment** and press the ▸ key on the Direction pad or the **OK** button to select it.



5. On the input screen that appears:



   a. Use the Direction pad to navigate to the next letter you want to enter (white letters on gray background; the current selection is highlighted in yellow).

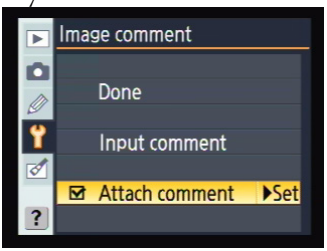
b. Press the **QUAL** button (🔍) to enter the letter selected in Step 5a into the current position in the bottom box (highlighted slightly with a light gray background and a darker letter if one is already entered).

c. If you need to move the cursor in the bottom box back to fix something, hold down the **ISO** button (🔍+) and use the Direction pad keys to move the cursor.

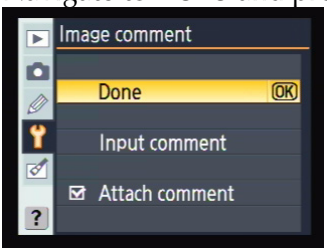
d. Use the Delete button to remove the currently highlighted letter from the bottom box.

e. If you have more letters to enter, return to Step 5a, otherwise press the **OK** button to return to the previous menu.

6. Use the Direction pad to navigate to **Attach comment** and press the ▸ key on the Direction pad or the **OK** button to select it. The box should be checked if you want to use the comment.



7. Navigate to **Done** and press the **OK** button to finish.



Note: Step 7 is necessary. Just performing Step 6 does not *actually attach the comment!*

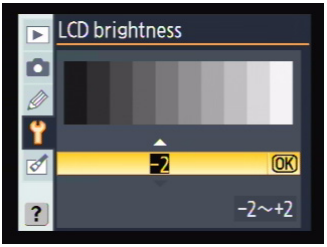
Tip: *As you can tell from the sample screens, I use the comment* **Copyright 2006 Thom Hogan/bythom.com** *on my D80. You can enter up to 36 characters in your comment. Choose wisely grasshopper. (One person has suggested that you enter* **IF FOUND CALL ###-####***, but remember this is what appears on your images—it doesn't normally show on the camera itself except during setting. It might make sense to put something like* **(c)2006 Thom Hogan ###-###-####** *though.)*

Setting the LCD Brightness

The D80 allows users to set a brightness value for the color LCD screen on the back of the camera:

1. Press the **MENU** key to show the menu system.
2. Use the Direction pad to navigate to the SET UP menu (the wrench icon).
3. Use the Direction pad to navigate to **LCD Brightness** and press the ▸ key on the Direction pad or the **OK** button to select it.

4. Use the ▴ and ▾ keys on the Direction pad to select brighter or darker display. You'll see a swatch of patches from black to white to help you assess your adjustment. You should see *every* ramp position in the swatches; if the two whitest swatches blend together, the brightness is too high, while if the two darkest swatches blend together, the brightness is too low.



Note in this sample screen how all the patches are clearly distinguished from each other. If two bright or two dark patches look nearly identical, you've set the brightness incorrectly.

5. Press the **OK** button to confirm your choice.

Novice DSLR users have a tendency to "crank up" the brightness of the color LCD. Moreover, they rely upon it too much to make visual assessments of the photo they just took. Unfortunately, both of these things are wrong.

The swatch of patches shown in Step 4 is there to help you get a full tonal range display from black to white with a complete gradation in between. If you arbitrarily set the brightness higher, you'll note that several of the patches on the right side become all white (the opposite, setting too low, would produce multiple black patches on the left side). You've effectively told the display to show all bright tones as white—you'll never be able to see what's going on in the highlight regions of your image.

The correct setting for the LCD brightness is to see all 10 of the tonal patches distinctly from one another and with even gradations, which almost always means a setting of **-1** on the D80 in normal and outdoor light.

But the bigger problem is that the color LCD is not color or brightness (gamma[73]) profiled[74]. If something looks too bright

[73]Gamma refers to how the middle gray setting is determined. In general, the D80's color LCD seems to have too low a gamma setting, and the tones on either side of middle gray are not perfectly symmetrical.

[74] Nikon makes a claim that the D80's LCD is "calibrated" in the factory, but this refers to the fact that all the LCDs are set exactly the same in the factory, not calibrated in the manner you do with a your computer monitor.

or too red on the color LCD, it may or may not be in your actual photo data. It's actually worse than that: the color LCD comes closer to reproducing the sRGB gamut than the AdobeRGB gamut. If the camera is set to sRGB as the Color Space, the colors you'll see are slightly more accurate. Many users who've set AdobeRGB complain of a slight green cast, though in looking at ColorChecker charts on my color LCD and moving between the various options I see very little meaningful difference.

I'll repeat: the *only* way to visually assess an image accurately is to display it on a color-calibrated monitor using the correct color space profile.

Setting the File Numbering Sequence

The D80 allows you to specify when file numbers are reset (as a reminder, the importance of file numbers was discussed in "File Names" on page <163>). As mentioned in the section labeled "File Numbering Sequence" on page <169>, you have three choices:

- **Off**. File numbers are always started at 0001 whenever a new folder is created, when the storage card is formatted, or a new storage card is inserted into the camera.
- **On**. File numbers are incremented until they reach 9999, at which point a new folder will be created and the file numbering will begin again at 0001.
- **Reset**. The file number is reset to 1+the current file number in the current folder (if there are no images in the current folder, numbering is reset to 0001).

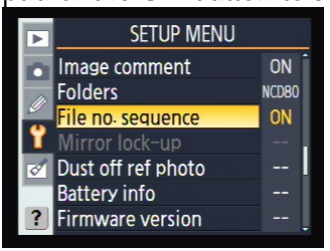
Of these options, **On** makes the most sense, and is the one I use on all my Nikon DSLRs. That's because file name duplication is dangerous—you could accidentally erase or overwrite a file you wanted to keep.

To set File Sequence Numbering:

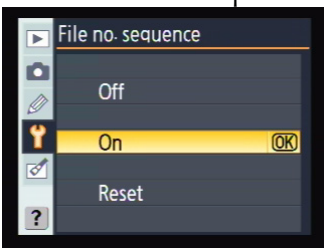
1. Press the **MENU** button to see the menu system.

2. Use the Direction pad to navigate to the SET UP menu (wrench tab) and press ▸ on the Direction pad or the **OK** button to select it.

3. Use the Direction pad to navigate to the **File no. sequence** option and press the ▸ key on the Direction pad or the **OK** button to select it.



4. Use the Direction pad to navigate to the option you wish to set (**On** is my recommendation) and press the **OK** button to complete the action.



Note that the file numbers you're configuring with this menu option are what the *camera* sets. If you follow my advice in the post-shooting section of this eBook, you'll have Nikon PictureProject (or whatever other program you use to transfer files from camera to computer) rename and renumber your images. In those software programs you're *not* limited to four digits, plus you might want to name images sequentially from a shoot (e.g. PhillyZoo0001, PhillyZoo0002, etc.).

Set Up Recommendations Summary

CSM/Setup menu set to **Full**
World time set to the current date, time, and time zone
Language set to your preferred language
Image Comment set to **(c) YEAR Your Name**
LCD Brightness set to **-1** or perhaps **-2**

File No. Sequence set to **On**
Auto image rotation set to **On** (covered in "Rotating Images" on page <380>)

Note that *none* of these things show up on the Top LCD or while you're shooting—everything we've set so far really only impacts data recorded with the image (date, time, comment, file number, and rotation) or how the menus appear (menu, language, and brightness).

The next section describes an item that *does* impact the Top LCD display and shooting, **Image quality**.

Image Quality

I covered it earlier (in "Image Formats" on page <119>), but since image quality and size settings are something that you normally attribute to "setting up the camera," this is a good place to summarize the choices and the method of setting them.

The D80 supports four basic levels of image quality (plus you can record NEF and JPEG qualities simultaneously:

RAW (NEF) Images are not demosaiced and do not have camera data applied to the pixel data; you're saving the 12-bit sensor data and a list of camera settings, not a finished image (though a finished **JPEG basic** thumbnail *is* saved in the file). The result is saved with a visually lossless compression. This is the highest quality image the D80 can create.

Fine (JPEG) Images are demosaiced by the camera, camera controls are applied, data is reduced to 8 bits, and compressed at a ratio of about 1:4 and stored as JPEG files. Compression artifacts are present, but generally not visible.

Normal (JPEG) Images are demosaiced by the camera, camera controls are applied, data is reduced to 8 bits, and compressed at a ratio of about 1:8 and

stored as JPEG files. Compression artifacts are present, and may be visible on close examination (especially if high sharpening values are used or you're using a high ISO value).

Basic (JPEG) Images are demosaiced by the camera, camera controls are applied, data is reduced to 8 bits, and compressed at a ratio of about 1:16 and stored as JPEG files. Compression artifacts are present and often visible (especially if high sharpening values are set and you're using a high ISO value).

You also have a choice of **Large**, **Medium**, and **Small** sizes in the three JPEG formats.

Starting out, you probably should select **JPEG fine Large** to shoot in, as this will result in high quality, reasonable-sized files that can be used in virtually any digital photo software product. It also has the decided advantage—in my humble and slightly sadistic opinion—of showing you when you make other setting mistakes, which helps you learn faster. What do I mean by that? Well, if you get the White Balance setting wrong while shooting JPEG images, the color in your photos will be wrong. If you get White Balance wrong when shooting NEF, you simply change the setting in editing.

Approximate Images Per Card

Format	Size	512MB	1GB	2GB	4GB
RAW	12400	42	85	169	338
JPEG Fine L	4800	109	218	437	874
JPEG Fine M	2700	194	388	777	1553
JPEG Normal L	2400	218	437	874	1748
JPEG Normal M	1300	403	807	1613	3226
JPEG Basic L	1200	437	874	1748	3495
JPEG Basic M	700	749	1498	2996	5992
NEF+JPEG Fine L	17200	30	61	122	244
NEF+JPEG Fine M	15100	35	69	139	278
NEF+JPEG Normal L	14800	35	71	142	283
NEF+JPEG Normal M	13800	38	76	152	304
NEF+JPEG Basic L	13600	39	77	154	308
NEF+JPEG Basic M	13000	40	81	161	323

Size is in K (e.g. 6000 is 6MBs) and some of these sizes are the average I've seen using my D80, not necessarily Nikon's listed sizes.

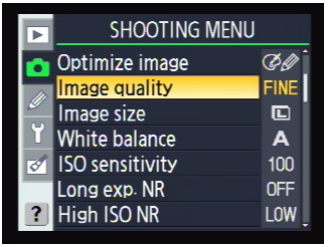
Note: Not all Secure Digital cards labeled of a particular size actually have the same capacity due to differences in file allocation and marked bad sectors. Moreover, a card marked 1GB often has slightly less than 1GBs of space. With larger capacity cards, actual capacity is typically about 5% less than stated size.

Thus, the numbers in the above table are an approximation only. If you shoot a scene with a great deal of detail and **Image sharpening** *set to* **High** *on a Secure Digital card that overstates its capacity, you may get significantly fewer images than listed in these tables, especially with JPEG images (sharpening adds more detail that JPEG has a hard time compressing). Conversely, if you shoot non-detailed scenes with* **Image sharpening** *set to* **None** *on an efficient Secure Digital card, you may get slightly more images than shown. Like EPA mileage labels on cars, what you actually achieve may not be what the manual indicated.*

To set **Image quality** (and **Image size**):

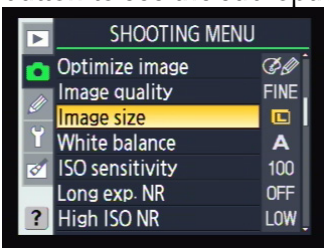
1. Press the **MENU** key to show the menu system.

2. Use the Direction pad to navigate to the SHOOTING menu (green camera icon tab).
3. Use the Direction pad to navigate to the **Image quality** option. Press the ▸ key on the Direction pad or the **OK** button to see the sub-options.

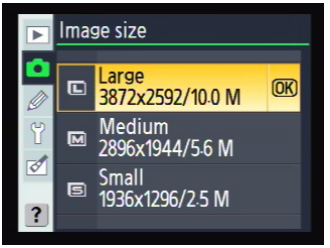


4. Use the Direction pad to navigate to the quality you want to use.

5. Press the ▸ key on the Direction pad or the **OK** button to set the quality. If you've set **NEF (Raw)** (no JPEG file added), you're done and can skip the remaining steps.
6. Use the Direction pad to navigate to the **Image size** option. Press the ▸ key on the Direction pad or the **OK** button to see the sub-options.



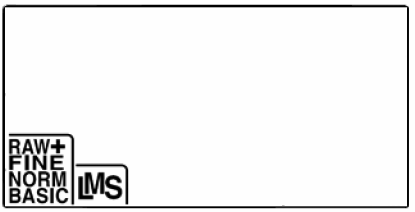
7. Use the Direction pad to navigate to the size you want to use.



8. Press the ▸ key on the Direction pad or the **OK** button to select it.

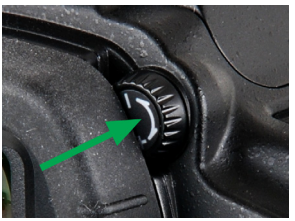
Alternatively, **Image quality** can be set by holding down the **QUAL** button and rotating the Rear Command dial; **Image size** can be set by holding down the **QUAL** button and rotating the Front Command dial. (Look at the Top LCD to see what you're setting.)

Top LCD:



Viewfinder Adjustment

The D80 allows you to adjust the viewfinder to help accommodate small differences in vision.



Just to the right of the viewfinder eyecup (green arrow points to it in above image) you'll find a small knob marked **+ ---- -**. What this knob controls is the diopter value used for the

viewfinder. Diopter is a unit of measurement that describes the refractive power of a lens. The default value (the center click stop on the dial, where **-** is exactly at 12 O'clock and **+** is at 6 O'clock) is set at –1 diopter, and the range that's supported directly by the viewfinder goes from –2 diopters to +1 diopter.

In prescriptions for glasses, negative diopter numbers indicate correction for nearsightedness. In camera viewfinders, the diopter value controls the apparent distance at which the viewfinder appears (the default is 1 meter away, the equivalent of –1 diopter). If your vision isn't sufficiently able to (or corrected to) focus on objects at that distance, you'll need to adjust the diopter value.

📷 To adjust the diopter value:

1. Defocus the lens on the camera until the scene in the viewfinder is completely blurred.
2. Point the camera at something plain, like a clear blue sky.
3. Look carefully at the *focus brackets* in the viewfinder. Are they sharp and distinct? If not, rotate the Diopter Adjustment knob until the focus brackets are sharp.
4. Verify the setting by having the camera focus on a subject and checking to see that the image in the viewfinder appears sharp (it may not be perfectly so, as the viewfinder glass tends to diffuse detail slightly, but you should still be able to verify that focus is sharp).

If you wear glasses or contact lenses, make sure to let your optometrist know that you're a photographer, and that the viewfinder image is formed at a distance of 1 meter with an eyepoint relief of 19.5mm. He may make slight adjustments to your prescription that helps you see the image in the viewfinder more clearly.

If you need more correction than the built-in adjustment allows, you can purchase alternative eyepiece correction lenses. You can buy –3, -2, 0, +1, or +2 lenses to add to the viewfinder, and it's easy to do (they mount in place of the DK-21 rubber cup). The range of adjustment remains the same. In other words, if you add a –3 lens, your adjustment range would be from –5 to –2.

Note: When you use the optional correction diopters, you can't use the DK-21 rubber eyepiece that comes with the camera, nor can you use the optional DR-6 right-angle finder or any of the other options that mount into the viewfinder eyepiece socket.

Focus Screens

The D80 comes with a focusing screen installed, and things like grid lines, which are usually supplied by substituting an E-type screen on other high end Nikon bodies, are instead done electronically (with an LCD overlay on the focusing screen; Custom Setting #8 on page <409>).

Resetting the Camera

Because the D80 has an enormous number of user-settable options, Nikon has provided a quick reset system to bring the camera back to the factory default settings.

Resetting Basic Settings

To reset the basic camera settings, hold the **AF** and Exposure Compensation buttons (both marked with a green •) for more than two seconds. The following basic camera settings are returned to their defaults (the first four items only apply to *the current Shooting menu bank*; see "SHOOTING Menu" on page <358>):

Settings after Reset

Setting	*Default*
Image quality	**JPEG normal**
Image size	**Large**
ISO Sensitivity	**100**
White balance	**Auto** with **0** adjustment (e.g. + and – adjustments are cancelled)
Focus area	Central sensor
Flexible program	Cancelled (e.g. camera follows regular program table)
Exposure lock	Off
Exposure compensation	0 stops (e.g. no exposure compensation set)
AE hold	Off
Bracketing	Off (bracketing increment is also reset to 0.3 stops or 1 for white balance bracketing)
Flash options	Front curtain sync (e.g. no Slow or Rear Sync option is set)

Resetting Other Settings

The two-button reset just described doesn't reset every menu option, nor does it reset Custom Settings (see "Custom Settings Reset" on page <396>).

The Last Resort Reset

The D80 contains considerable electronics, including a CPU and dedicated digital processors. Like a computer, it can sometimes get confused. If the camera is locked up or displaying unusual or garbled characters, you've got one last option for resetting the camera:

1. Turn the camera OFF.
2. If you're using battery power, remove the main battery. If you're using AC Power, unplug the adapter.
3. Turn the camera ON until the clock battery runs down (note that this may take several days). If you're in a hurry you can try leaving the camera ON for only a

few seconds, but this doesn't fully reset some of the internal parameters.

4. Turn the camera OFF.
5. Put the battery back into the camera or restore AC power.
6. Turn the camera back On.

If the camera is now working normally, set the date, time, and any other settings you may have lost (the camera should be set back to the way it came from the factory). If the camera still isn't working properly and you've checked to make sure that you haven't made a setting that is causing a problem, you'll have to return it to Nikon for servicing (see "Getting Service" on page <704>).

Why turn the camera On in Step 3? We want the camera to exhaust any internal capacitors that are storing charge and holding values that need to be reset. We want the camera to come up in a "clean" state when we restore power.

Firmware Version

The D80 shipped with firmware labeled A1.00 and B1.00. As of this writing, no updates have been made.

Note: The pair of letter-number combinations refer to different sections of the software in the camera. Speculation has it that A refers to user software (menu system) after initialization, while B refers to the low-level firmware.

To determine which version you have:

1. Press the **MENU** button to see the menu system.
2. Use the Direction pad keys to navigate to the SET UP menu (wrench icon).

3. Use the Direction pad keys to navigate to **Firmware version**.

4. Press the ▸ key on the Direction pad or the **OK** button to display the firmware version.

To update your D80[75]:

1. First, download the firmware updates from one of the Nikon Web sites.
2. Even though the firmware file is relatively small, Nikon usually chooses to compress the file, so you'll need to use Winzip (Windows) or Stuffit (Macintosh) or equivalent programs to expand the archive into the update files. The names for the update files will be something like AD80###.BIN and BD80###.BIN. *Note:* Be sure to verify the exact name from the Nikon

[75]**Warning**: These instructions are predicated on how Nikon has done D200 and other DSLR updates. It's quite possible that the update routine may change in the future, so please double check the instructions on Nikon's Web sites before attempting any firmware installation. Also note that sometimes only an A or B update is done, not both simultaneously as described here. Finally, the order in which the A and B updates are done could change in the future. Always look at Nikon's instructions and follow them if they differ from the ones shown here. However, Nikon usually gives update instructions that require your camera to be connected to your computer via the USB cable, and that's not the only method possible of getting information to the camera.

Web site. If it's different than the above, you'll need to substitute the right name in the steps below.

3. Copy only the AD80###.BIN file to the *top level* (root level) of a Secure Digital card. Do not place it in the DCIM folder!
4. Put the card you created in Step 3 into the camera.
5. Make sure the camera battery is fully charged or you are using AC power via the AH-5.
6. Press the **MENU** button to see the menu system.
7. Use the Direction pad keys to navigate to the SET UP menu (yellow wrench icon).
8. Use the Direction pad keys to navigate to **Firmware version**.

9. Press the ▸ key on the Direction pad or the **OK** button to display the firmware version. Navigate to **Version Up** and press the ▸ key on the Direction pad or the **OK** button a second time and you should see a firmware update dialog.
    a. Use the Direction pad to navigate to **Yes**.
    b. Press the **OK** button to start the update.
    c. Wait until you see a message on the color LCD that indicates that the update has been completed.
    d. Turn the camera OFF and remove the card.
    e. Turn the camera ON, press the **MENU** button, navigate to **Firmware Version** on the SET UP menu, press the ▸ key on the Direction pad or

the **OK** button and verify that the updated version appears in the screen that appears.

10. Erase the AD80###.BIN file from the card, and then repeat Steps 3 through 9, except with the BD80###.BIN file.

Shooting Pictures with the D80

Camera and Shooting Controls

Now that we've gotten some basics and initial camera set up out of the way, let's look at the specific controls that come into play as you take pictures.

This section of the eBook is the portion you'll want handy when you're out shooting, as it examines each of the D80's main controls and tells you when and how to use each.

We'll start off the section by locating and labeling all the controls (buttons, switches, and dials), then drop down into the various sub-components in detail.

D80 Controls

Note: On the CD I've provided a file named D80CALLOUTS.PDF*, which has only the following Control and Display sections in it. You can print that out and use it for reference as you follow along in the rest of the book (or laminate it and use it as a field cheat sheet!).*

Note: I've mounted the MB-D80 on the D80 body in the following illustrations. If you don't have an MB-D80, some numbered items may not apply to you.

Front View

1. Focus Mode Selector switch
2. Lens Release button
3. Infrared receiver
4. Self-Timer, Autofocus Assist, Red-eye Reduction lamp
5. Depth of Field Preview button
6. **FUNC** (user-assignable) button
7. Front Command dial(s) (called sub-command dials in Nikon manuals)
8. Shutter release(s)
9. Vertical Shutter Release Lock lever
10. MB-D80 Mounting wheel
11. Lens Alignment mark
12. Lens Strap attachment points

Top View

13. Metering Method button (doubles as **Format** button)
14. Exposure Compensation button (doubles as Reset button)
15. Flash hot shoe (under removable plastic protector)
16. Power switch (extreme position is LCD illumination)
17. Top LCD Display panel
18. Focal Plane[76] indicator ϕ
19. Exposure Mode dial (Mode dial in Nikon manual)
20. Frame Advance button
21. AF button

[76]What's a focal plane? It's the point at which the image is focused (i.e. the surface plane of the sensor for a D80 or the surface plane of the film for a 35mm film camera). In close up (macro) work, it's sometimes necessary to measure distances from the focal plane, thus the mark.

Back View

22. Delete button (doubles as **Format** button)
23. Color LCD display
24. Viewfinder eyepiece
25. Diopter Adjustment knob
26. **AE-L/AF-L** button(s)
27. Rear Command dial(s) (main command dial in Nikon manuals)
28. Autofocus Area Direction pad (doubles as Autofocus Sensor selector and Direction pad for the menu system)
29. Direction Pad Lock lever
30. Playback button
31. **MENU** button
32. Thumbnail button (doubles as Zoom Out and **ISO** button)

33. Protect button (doubles as Help and **WB** button)
34. Zoom In button (doubles as **QUAL** button)
35. **OK** button
36. Secure Digital Card Access lamp
37. MB-D80 Battery Compartment Door latch

Side Views

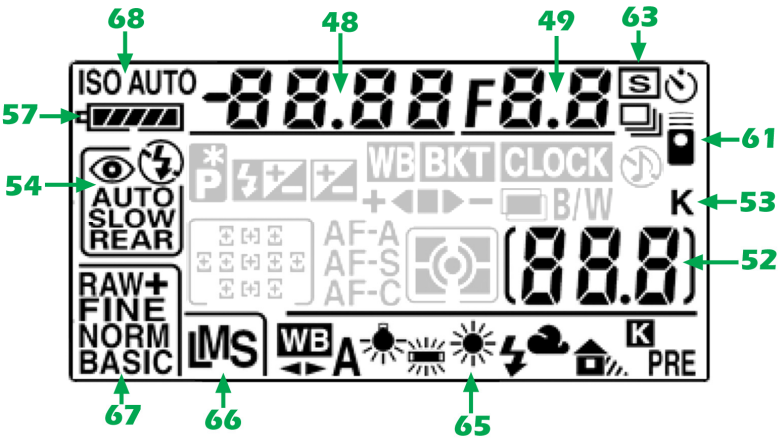
38. Secure Digital Card Access Door (door slides towards back of camera—two green arrows—and then springs to open position shown)
39. Flash Release button; doubles as Flash Options button (Flash Sync Mode in Nikon manual) and Flash Exposure Compensation button
40. Bracketing button
41. Wired remote connector (under bottom rubber flap)
42. Video Out connector (under top rubber flap)
43. DC In connector (under top rubber flap)
44. USB connector (under top rubber flap)

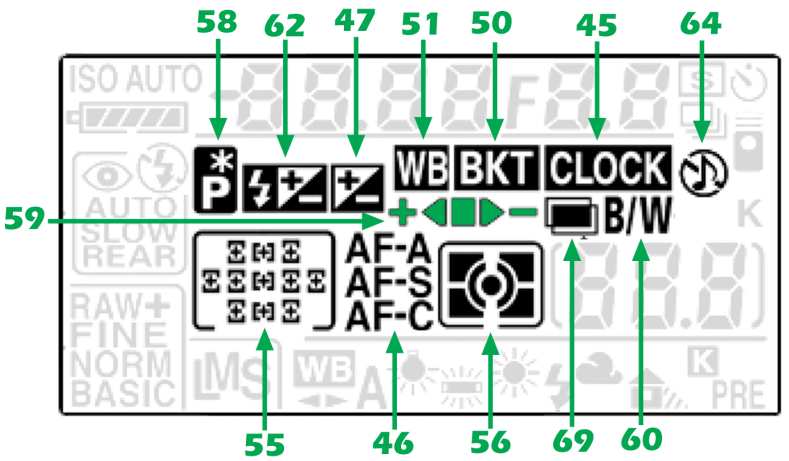
D80 Displays

The D80 features three displays, all of which can present information about the current camera settings.

On the top of the camera is the familiar (to 35mm film users) informational panel (called the Top Control Panel by Nikon), though it displays additional information not found on the film bodies. This monochrome LCD is primarily used to show the camera's main shooting modes, exposure settings, frames shot and remaining, and active primary features. Most of the information on the top LCD is associated with camera controls on or near the top of the camera. A few of the areas on this LCD have multiple uses, so pay close attention to the information being presented. In this book, whenever I refer to "top LCD," I'm referring to this display.

D80 Top LCD





45. Internal Clock Battery Condition indicator CLOCK
46. AF mode indicator **AF-S, AF-C, AF-A**
47. Exposure Compensation indicator
48. Shutter Speed indicator/Exposure Compensation value/Shots in Bracketing indicator/ISO indicator - 88.88
49. Aperture indicator/Bracketing Increment indicator/PC Connection indicator F8.8
50. Exposure Bracketing indicator **BKT**
51. White Balance Bracketing indicator **WB**
52. Frame Count indicator *Note: remains displayed even when camera is turned OFF.* 888
53. Over 1000 Frames indicator **k**
54. Flash Options indicators **AUTO, SLOW, REAR**
55. Focus Area and Focus Area mode indicator
56. Metering Method indicator
57. Battery Condition indicator
58. Flexible Program indicator *
59. Bracketing Progress indicator +–
60. Black & White indicator **B/W**
61. Wireless Remote indicator
62. Flash Exposure Compensation indicator
63. Frame Advance indicators S
64. Beep indicator
65. White Balance indicators PRE (◆ indicates you've altered the basic value)

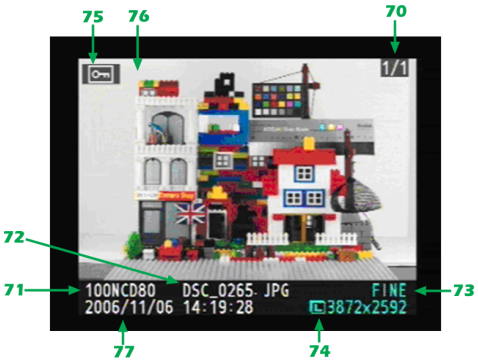
66. Image Size indicators (**L** = large, **M** = medium, **S** = small)
67. Image Quality indicators (**RAW**, **FINE**, **NORM**, **BASIC**)
68. Auto ISO indicator **ISO-AUTO**
69. Multiple Exposure indicator

D80 Color LCD

On the back of the camera is a large (~2.5″) color LCD (Nikon refers to this as the "Monitor"), which can be used to review images taken with the D80.

The color LCD displays 100% of the picture when viewing images. If you've turned on automatic rotation of vertical images for playback (PLAYBACK menu, **Rotate tall** option), the color LCD rotates those images.

In this book, whenever I refer to the "color LCD," I'm referring to this display.



The color LCD is okay for casual previews of images, but don't count on using it to critically evaluate sharpness or color balance. It's most useful function is for judging composition and for analyzing information from the image (histogram, highlights, etc.).

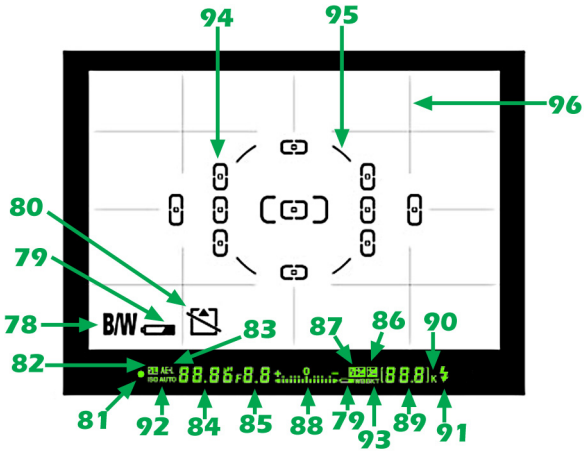
70. Frame Number indicator (upper right corner) **1/1**
71. Folder Name **100NCD80**
72. Filename **DSC_0265.JPG**
73. Image Quality **FINE**
74. Image Size (L, M, or S) **L 3872x2592**
75. Protected File indicator
76. Modified Image indicator
77. Date and Time **2006/11/06 14:19:28**

Note that other information about the photo appears on separate information pages (selected by pressing the ◀ or ▶ keys on the

Autofocus Area Direction pad while viewing images). See "Image Review" on page <373>.

D80 Viewfinder

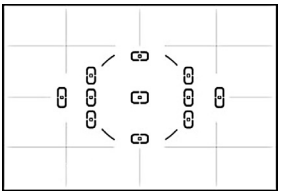
When you look through the viewfinder, you'll see an information display below the image area. This lighted display is activated when you press the shutter release partway, and turns off automatically with the metering timeout to conserve power. In this book, whenever I refer to the "viewfinder display," I'm referring to this information.



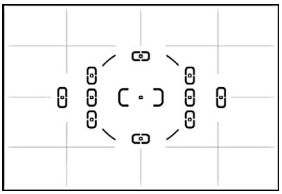
78. B&W Shooting indicator **B/W**
79. Battery indicator
80. No Memory Card Warning indicator
81. Focus Confirmation indicator •
82. Flash Lock indicator **FL**
83. Exposure Lock indicator **AE-L**
84. Shutter Speed value 88.86
85. Aperture value F8.8
86. Exposure Compensation indicator
87. Flash Exposure Compensation indicator
88. Manual Exposure display/Exposure Compensation setting
89. Frame Count indicator/Frames Remaining indicator/Exposure Compensation value/PC Connection indicator 88.8

90. Over 1000 Images indicator **k**
91. Flash Ready light
92. Automatic ISO indicator **ISO-AUTO**
93. Bracketing indicators **WB-BKT**
94. Autofocus Sensor areas
95. Center-Weighted Metering area
96. Viewfinder grid lines

Autofocus Sensor indicators that double as spot meter targets are superimposed over the image. Note that two kinds of AF indicators can appear: normal central and wide central area (chosen with CSM #3, see page <401>).



Normal center



Wide center

The highlighted area indicates the active autofocus sensor (or sensors). I'll have a lot to write about this in various sections of the eBook, but pay close attention to spot metering (see "Spot Meter Point" on page <222>).

The large circle superimposed over the image in the viewfinder helps you estimate the area used for center-weighted metering. The area used for center-weighted metering can be changed using Custom Setting #12 (see page <413>). The displayed circle corresponds to the 8mm setting (if you change the setting, you have to guess at the circle size in the viewfinder).

The image area you see in the full viewfinder is approximately 95% of the area that is seen by the sensor when shooting normally. I personally would have preferred 100%.

Metering and Exposure

Cameras need some way to adjust the amount of light that gets through to the digital sensor (CCD). In very bright scenes, for example, we may need to limit the total amount of light or the time that the light hits the sensor. In dark scenes, we may need to increase the total amount of light or time the light gets into the camera. Such control is called "setting an exposure."

For any fixed amount of light and camera ISO setting, there is one or more aperture opening (size of the hole in the lens) and shutter speed combinations (length of time the CCD gets light) that can be used to get a "correct exposure."

Way back in the early days of film photography we used to have to measure the amount of light by using an external (handheld) meter, and then manually set both the aperture and the shutter speed on the camera. Today, all SLR-type cameras such as the D80 have multiple automatic ways to do the same thing.

First, the D80 has an internal and automatic metering system (see "Metering Methods" on page <215>), and this system has a variety of settings to control how the metering is accomplished. Second, the D80 has multiple methods of interpreting what the meter says is the proper exposure, called *exposure modes* (see "Exposure Modes" on page <236>). We need to examine both things, as they directly contribute to getting the right exposure.

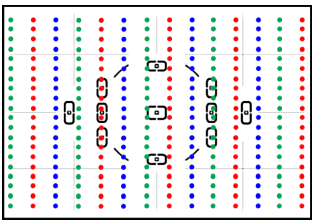
Metering Methods

The D80 has three metering methods available:

Matrix

Matrix metering is a system that divides the image area into pieces (the "matrix") and analyzes the differences between them. The brightness pattern seen in the matrix is compared against a Nikon-proprietary database of image patterns stored in the D80's internal memory, and the exposure is set accordingly.

The D80 uses a dedicated 420-cell CCD in the viewfinder to provide metering, the same as the D50 (other Nikon bodies use a 1005-cell CCD). The "brains" behind the matrix metering has been significantly improved over the years. Older versions of this metering system used a 30,000 pattern database to test against; the D80 used ten times that number in development, plus there appear to be significant improvements in handling pure white and pure black. Nikon calls the current iteration of this metering system 3D Color Matrix II.



The 420-cell CCD covers most of the image frame. The matrix consists of alternating color sensors (RGB; but it's not the Bayer pattern described in the section on the sensor).

If a D-type or G-type lens is used (with or without flash), matrix metering also takes into account the focus distance (the "3D" in the name) to help guess where the subject is and what kind of shot you're taking. *Example*: normally, the matrix meter discounts brightness in the upper half of the scene, as it thinks this is sky, and unimportant; however, if you're using a wide angle lens and are focused near infinity, the camera thinks that you're taking a landscape photo and doesn't discount the sky exposure as much.

The D80 matrix metering system relies on five key data points:

1. The overall brightness of the scene.
2. The differences in light measured across the 420-pixel sensor data (i.e. the "patterns").
3. The focus area that has been selected (which the camera assumes says something about where the "subject" is located).
4. Distance information from the lens.

5. The color (or colors) of the areas measured.

The key word in item #2 is "differences." Sky, for example, is usually very bright; near subjects we photograph tend to be less bright[77]. You can probably guess that if the upper left and upper right areas metered are considerably brighter than the lower left and lower right areas and are mostly blue, then the camera is going to think you're taking a picture of someone with sky in the background. In such a case, the sky usually isn't considered as important to the exposure, so the camera adjusts its exposure to match what it sees in the other areas. Just remember that it's the *difference* in brightness between areas that is a primary key to the matrix metering system, not the actual values measured.

However, note that no meter can perfectly deal with any situation that has a higher contrast range (large variation in brightness; remember I call this *exposure range*) than the dynamic exposure range of the camera (which, by the way, describes about half of the daylight scenes you might shoot). In scenes with a large exposure range either the bright portions of the scene will have to be overexposed or the dark portions underexposed.

One thing that catches many by surprise is that the D80's matrix meter doesn't try as hard as the D200 to preserve highlight detail over shadow detail in high contrast situations. A highlight, once overexposed, is unrecoverable on a digital camera (on print film, you could often recover something that was as much as three stops overexposed). The D80 does less of this highlight preservation than the D200 matrix meter does, apparently to keep the average scene brightness up and keep shadow detail in printable ranges. In a high contrast scene the D80 tends to produce slightly "brighter" exposures than the D200. The D50 also does this, which indicates that Nikon is making a specific change for the more consumer-minded user, who tends to not post process their images.

[77] An early Kodak study showed that most outdoor scenes tend to form a bell curve in overall exposure range, with something around 7.5 stops being the peak (160:1).

More specifically, it appears that "bright" areas that fall under the autofocus sensor being used have a tendency to bring the exposure down considerably in the D80's matrix metering. Indeed, close examination of the matrix metering on the D80 shows that it is actually quite preferential overall to what's happening in the area underneath the active autofocus sensor. Put something brighter than middle gray under the active autofocus area and the D80 exposes for it (producing underexposure as the meter tries to make the bright thing gray). Put something dark in that area and the camera does the opposite: it will tend to overexpose the rest of the frame slightly. The D200 and D2 series cameras don't display this same level of autofocus bias for matrix metering.

Whether the camera picks the right thing to expose properly depends upon a number of things:

- If the difference in brightness across the entire matrix meter is minimal (by definition, a low contrast scene), the matrix metering is quite good (and the meter tends to use what it sees in the central region as the primary measurement, almost like center-weighted metering). Indeed, even color variations tend to be exposed well in this situation[78]. One might argue that such exposures are slightly brighter than expected (perhaps by a third of a stop), but they generally don't have blown highlights and print well. The slight overexposure tends to mask any noise, as well.
- Nikon's matrix meters almost universally significantly underexpose off-center subjects in very high contrast situations, especially so if the subject is outside the autofocus sensor areas. The D80 is somewhat prone to

[78]A "middle yellow value" doesn't have the same reflectance as a "middle gray value," or a "middle red value" for that matter. The color ability of the Nikon matrix meter corrects for this, however. If your subject is a big gray blob filling most of the image area, the gray blob will be placed near the midpoint in the dynamic range of the camera. If your subject is a yellow parakeet filling most of the image area, the parakeet's yellow will be placed near the midpoint in the dynamic range of the camera. Why "near" and not "at?" Because Nikon tries to account slightly for perceptual differences between colors.

this, but not as much as other Nikon bodies (other than the D50) in my experience. If the camera sees a very bright area anywhere near the center of the frame or under the current AF sensor, watch out, the camera will likely base its exposure there. And if you're using manual focus and the subject is off-center and not in focus according to the current AF sensor, consider the warning doubled.

- Centered subjects that don't fill more than a third of the frame are also likely to show overexposure outside the central area in high contrast situations. That's truer if the lower left and lower right regions have brighter areas in them (relative to the subject). That's because the camera tends to use an average of the central and lower regions in very high contrast scenes, and the subject in this case doesn't fill enough of the image to influence the average.

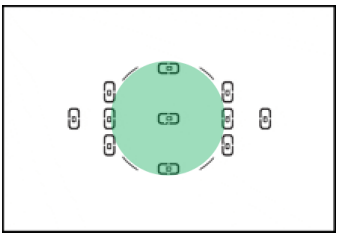
Don't panic. While that was a lot of detail, we'll make a bit more sense of how to evaluate an exposure in the Histogram description coming up later in this section.

But one final word is in order: matrix metering on the D80 is slightly less consistent than on the more expensive Nikon DSLR bodies, mostly because it pays a bit too much attention to the areas under the AF sensors and often also optimizes for rendering shadow detail over highlight detail. Most amateurs tend to center their subjects in their photos and complain about any underexposed areas before they complain about too bright areas, so perhaps that explains the bias. If you need absolutely consistent frame-to-frame metering that you control, consider learning and using the center-weighted metering option, described next.

Center-weighted

Nikon's center-weighted metering system measures the entire frame, but effectively separates it into two zones, the central area and the outer area. The exposure is based 75% on the central area, 25% on the outer area. (Note that the manual text doesn't mention 75/25, but Nikon's technical specifications do.) In other words, if the central area metered

f/4 at 1/125 and the outer area metered f/16 at 1/125, the exposure would be set somewhere around f/5.6 at 1/125.



Center-weighted metering normally uses an area about the same size as the circle you see etched in the viewfinder (green area in illustration at left) for 75% of the metering value. The remaining 25% of the meter value is based on the area outside this circle (white area in illustration)

The central measuring area is normally about the same size (0.31" [8mm]) as the area indicated by the large circle etched in the viewfinder (the one that touches the top and bottom autofocus sensor indicators). You can change the size of the central area by using Custom Setting #12 (see "Center-weight Circle Size" on page <413>), though I personally don't find this to be an overly useful feature.

One throwaway note in Nikon manuals should be noticed by all: if you're using a filter that has an exposure factor of one stop or more, use Center-weighted metering instead of matrix metering. That would, for instance, apply to polarizing filters.

The reasoning behind switching metering types with strong filters is simple: the matrix patterns were created using no filtration. Strong filters, especially ones that alter color, can greatly alter what the matrix sees. For example, a polarizing filter brings down a bright sky value quite a bit without affecting foregrounds at the same level. That means that the matrix pattern for "landscapes with sky" might not be recognized as being the one to use.

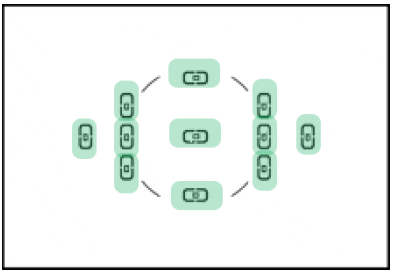
Spot

Most professionals tend to use spot metering when they have enough time to do a critical evaluation of a scene. That's because they can isolate individual bright and dark objects to help make critical exposure decisions.

Nikon claims that Spot metering targets a tight 3.5mm area (approximately 2.5% of the frame). The spot area is always centered on one of the autofocus sensors. I question the tightness claim, however. In practice I see "exposure pollution" with point sources of light over a far greater area than 2.5% on my D80 body (and usually a bit more elliptical in nature than circular). The spot pattern on the D80 is not as tight as it is on many other Nikon bodies I've used.

I think this has to do with the seven segment AF sensor used. So read the section on the autofocus sensors carefully and compare what you learn about their shape and size to what you see while spot metering. I think you'll come to the same conclusion I did: the spot meter on the D80 isn't as tight, and tends to follow the size and shape of the physical AF sensor (as opposed to the AF indicators in the viewfinder) more than expected.

The spot metering point follows the autofocus sensor being used. Most photographers use the outer edges of the autofocus brackets to envision the circle of what's being metered. This gets them into trouble sometimes. The actual area is at least 50% larger than the brackets in size, and a different shape (see illustration, below).



Spot metering occurs centered on one of the autofocus sensor areas. Note the area metered is larger than the autofocus sensor brackets indicate.

Note: There are a couple of spot metering nuances that catch some users by surprise (and confuse others). Like most other recent Nikon bodies, the D80's spot meter uses the currently selected autofocus sensor most of the time (see "Metering Compatibility," below). But in Dynamic Area autofocus modes the D80 tries to follow subjects that move

across the frame, and may use different sensors.

The D80 normally uses the autofocus sensor you selected using the Direction pad as the initial sensor. In Dynamic Area autofocus mode, if the camera detects that the subject has moved it also moves the autofocus sensor being used and spot metering follows! But in Single Area autofocus, the spot metering will stay put. Switch the camera to manual focus and it will use the currently selected autofocus sensor for spot metering.

Spot Meter Point

Focus Setting	*Spot Metering occurs at*
Manual focus	Highlighted AF sensor
Single Area AF	Highlighted AF sensor
Dynamic Area AF	AF sensor actually used for focus
Auto Area AF	Center sensor

Metering Compatibility

Lens Type	*Matrix*	*Center-weighted*	*Spot*
AF type D or G	Yes[1]	Yes	Yes
AF-S or AF-I	Yes[1]	Yes	Yes
AF-I Teleconverter	Yes[1]	Yes	Yes
AF (non-D)	Yes	Yes	Yes
AI-P[2]	Yes	Yes	Yes
AI, AI-S, or AI upgraded	No	No	No
AI Teleconverters	No	No	No

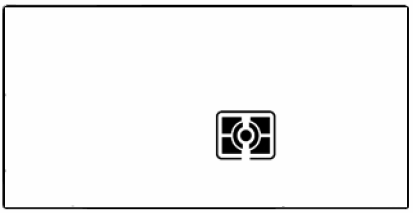
[1] *3D metering (distance information used)*

[2] *The PC Micro Nikkor 85mm f/2.8P only meters correctly when not shifted*

Setting the Metering Method

Just in front of the top LCD press the Metering Method button (⊡) and rotate the Rear Command dial until the top LCD displays the icon for the metering method you desire.

Top LCD:



The D80 viewfinder does not display the metering method icon, so unlike the higher end Nikon bodies, you'll usually have to take your eyes from the viewfinder to make a metering change (*tip*: if you need to change back and forth between two metering systems a lot, use the **FUNC** button assignment to activate the second metering method; see page <419>).

So Which Metering System Should You Use?

Short answer: matrix for most situations; center-weighted or spot metering for backlit subjects in very bright light (snow, sand, etc.).

Given that matrix metering is accurate most of the time and that the other methods require some knowledge of exposure and how to set them accurately, many D80 purchasers probably don't have the wherewithal to use the other methods and obtain more consistent, accurate exposures. In other words, ask yourself first whether or not you have enough knowledge to do a better, more consistent job than the matrix metering system is producing.

Even if the answer to that question you just asked yourself is "yes," you still have the Histogram and Exposure Compensation to help "tune" your exposures (see "Options for Evaluating Exposure" on page <228> and "Exposure Compensation" on page <270>).

Using other metering methods boils down to three situations, basically:

1. In very bright situations (snow, sand, etc.), the matrix meter's ability to measure light accurately can be compromised by its upper brightness limit. Center-weighted metering may give you slightly more accurate results, assuming you're using this method correctly.
2. You're coming from a film camera that sets exposure using the center-weighted method, and you're more

comfortable keeping the same system on your new DSLR. If that's the case, by all means change the metering system of your D80 to Center-weighted. With Custom Setting #12 (see page <413>) you can even tune your weighting to more closely match that of the camera you used to use. Be aware, however, that the Custom Settings reset (see page <396>)—may change the center-weight circle size back to 8mm if you've changed it using Custom Setting #12.

3. You understand exposure and tonal values well and encounter situations where a precise setting for a particular object is necessary (metering off a gray card so that a particular object falls to a specific differential exposure value; for example, you want a very dark bison to be the very dark color he really is, not exposed to become more like a middle tone value[79]). If you've got the knowledge of how exposures work and need to make specific readings of small portions of the scene, by all means try spot metering. Just be aware that the "spot" follows the focus point selected (see "Spot" on page <220>).

One last comment: because the D80 tends to set exposures more brightly in matrix metering than, say, a D200, some D80 users have resorted to setting an exposure compensation value of -0.3 or -0.7EV. Their theory is that this will provide more "equal" exposures with their other Nikon DSLR bodies. To some degree, that's true, but the D80 (and D50) have a somewhat different approach overall to evaluating the matrix, so you'll never get an exact match. If you're trying to match exposures between cameras, you'll either need to meter with only one (and manually set the exposure on the other), or use center-weighted or spot metering on both.

[79]Not to be condescending, but if you didn't understand what I wrote there, spot metering probably isn't for you. Spot meters allow you to isolate one particular thing in a scene and then use the information you obtain to place the tonal value for that object at a particular place within the dynamic range of the capture device. As the previous sentence implies, you have to understand and master quite a few bits of information to use a spot meter well. Indeed, entire books have been written on the subject.

Metering with Digital Requires Care

For some of you reading this eBook, the D80 is your first excursion into digital SLR cameras. If you've previously used a 35mm SLR body with print film, you're likely going to be a bit frustrated with exposure when you first start using the D80.

Print film has advantages that you may not have known about, but certainly benefited from:

- *Print film has a wide "latitude," or tolerance to exposure error*. Indeed, overexposing print film is something that professionals tend to do routinely, as it has little consequence on highlight detail but increases density of shadow areas for most films.
- *Print film has a wider dynamic range*. Print film holds a wider range from dark to bright than does a digital camera. Views differ on the exact difference, but it could be as much as three stops.
- *Automated print processors "fix" most minor problems*. Besides correcting for exposure errors of from –2 to +3 stops, they also rebalance colors.

When you use a DSLR, you lose these advantages. Exposure for digital cameras has to be precise—there is virtually no margin for error[80].

Consumer digital cameras such as the Coolpix do a great deal of image post-processing (a bit like those automated print machines used in the lab where you had your film developed), and often make substantive contrast changes to deal with exposure errors. In some more sophisticated cases, the highlight values are "compressed," sacrificing bright detail

[80]You'll hear that NEF files (raw files) can have their exposure adjusted after the fact. That's not exactly true. When you use a conversion program to change NEF exposures you don't actually change the exposure, you mostly change the way the underlying data is interpreted (similar to using a Curve in Photoshop). Since NEF data stays in the 12-bit realm, it may sometimes seem like you're recovering "lost" highlight detail while making a post processing "exposure adjustment," but you're not.

for overall contrast. For snapshot shooting and small print sizes, that's a tolerable tradeoff.

But one reason to move to a DSLR is to get away from a key liability of the consumer digital cameras: propensity for noise (especially in shadow areas). Heavy contrast and exposure modification in camera tends to make any underlying noise properties more visible, thus DSLRs are less aggressive at "fixing" exposures, even though they have better noise tendencies than their consumer cousins. (The D80, however, is more aggressive about that than the D200.)

So, by moving to a DSLR you get more control over what the camera does. Heavy post-processing of images by the camera would prevent you from exercising that control.

Let's cut to the chase: shooting with a DSLR like the D80 is akin to shooting with slide film on a 35mm SLR: to get the best possible image quality out of the camera, you'll need to be fairly precise in setting exposure. Overexposure results in loss of data (on slide film, clear acetate; in digital, values exceed the highest value that can be recorded by the bits available).

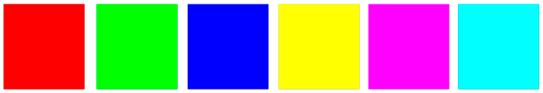
Nikon's DSLR designs, to date, all attempt to preserve some highlight detail with their matrix metering system. The D80 does, too, though less so than the D200. In digital, when more light photons hit the sensor than it can hold (i.e. overexposure), no additional data is recorded; the photosite is saturated. This is like a brick wall for exposure: any truly overexposed area will simply record as the maximum data value (255,255,255 for 8-bit data; 4095,4095,4095 for 12-bit data). This is called "blowing out the highlights." With inkjet printer technologies, no ink is put down on the paper in areas at the maximum data value, making for a visible discontinuity if you look carefully. Overexposure is therefore bad news.

Unfortunately, underexposing on any DSLR has the tendency to increase noise when you later adjust the image. Thus, you're often put into the situation of needing to choose

between preserving highlight detail or revealing noise. I'll discuss this again later in the eBook, but the short answer: almost always you should preserve the highlight detail, even if it'll eventually mean that you have to sacrifice some shadow detail.

I should also point out that individual color channels can be blown out. This actually is the most difficult thing to learn about digital exposures: your exposure may look correct, but if an individual color channel is blown out (a value of 255 for JPEGs or 4095 for NEFs), this will come back to bite your butt later. This is still true for those that shoot NEF. In particular, I've learned the hard way that the red channel is prone to blow out with red and near-red flower blossoms in bright light. What happens then is that you lose any chance of manipulating color after the fact without getting what I call "nuclear colors" (see petal of rose in shot, below [taken from a converter test in my newsletter]).

In my newsletter I pointed out that digital photographers need to learn the colors that trigger channel blow out. Bright red, bright green, and bright blue are easy to recognize, but learn to recognize the colors produced by maximum Red+Green, Red+Blue, and Blue+Green channels. See one of those six colors in the brighter areas of your scene? Check the color histograms to make sure you haven't blown out a channel (see "Options for Evaluating Exposure" on page <228>). Just so that you know which colors I'm talking about, here they are:



Yes, those are old favorites: red, green, blue (the primary colors picked up by the sensor) and yellow, magenta, and cyan (the alternate colors on the color wheel). Of the six, I find myself blowing out the Red channel a lot (red patch), and Red+Green channels a lot (yellow patch).

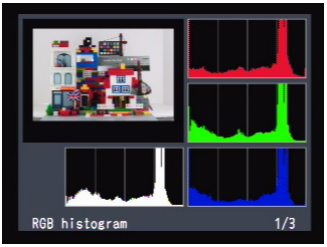
In short, take the time to learn how to control exposure with your D80. Fortunately, the camera has some useful tools that'll help you do just that, which I'll cover next.

Options for Evaluating Exposure

The D80 has two useful exposure evaluation features that analyze the exposure data after you've taken a picture: RGB Histograms and Highlights displays.

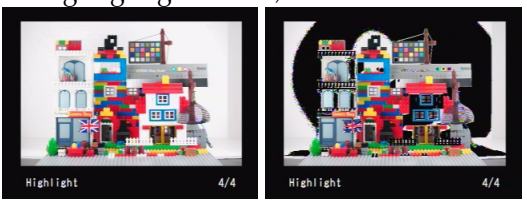
Here's what each of these displays shows:

RGB Histogram Provides an information display page for each image that shows overall and individual channel histograms for the image. This helps you detect channel blowout (individual channel histograms) as well as basic overexposure (luminance histogram). The individual channels are on the right and colored to match the channel (red = red, green = green, blue = blue). The white histogram below the image is the luminance histogram.



Highlight

Provides an information display page on the color LCD for each image that shows locations of pixels that exceed a maximum usable value by blinking them. If a large group of pixels is blinking, you may have overexposed the image (at a minimum, you're likely losing highlight detail).



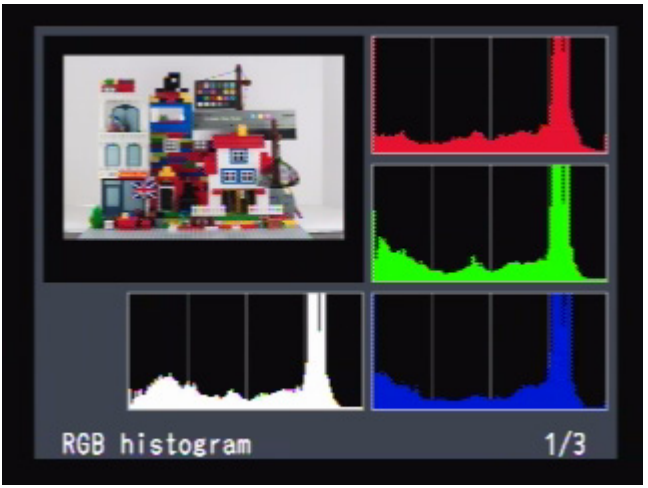
Note black area in the right-hand screen. That blinks to indicate that this section of the image has exceeded the camera's preset white level and is probably blown out (has no detail).

Note: **Highlight** *worked slightly different on the original D1 than it does on all subsequent Nikon digital SLRs, which could be important to understand if you're upgrading from a D1 to the D80. On the original D1, only pixels that were 255, 255, 255 (absolute white) were blinked. On the D80, pixels "near" absolute white are also blinked (Nikon hasn't disclosed what level triggers blinking, but any channel that has a value of about 245 or above will usually trigger highlight blinking). Basically, Nikon tweaked this function so that it more accurately shows when you will be generating areas that have no usable highlight detail.*

How to Interpret Histograms

Much has been written about how useful it is to see the exposure histogram on the color LCD after taking a shot. However, not everyone understands exactly what he or she is seeing.

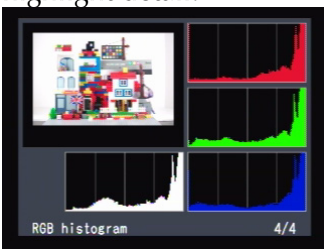
Each histogram's horizontal axis ranges from dark valued pixels (0=black) at the left to bright valued pixels (255=white) at the right. For the main histogram (white graph), the horizontal axis shows the *luminance* channel and does not tell you anything about the individual Red, Blue, and Green channels. Those channels have individual histograms (colored to match the channel) that appear on the right side of the display:



The vertical axis for each histogram is the number of pixels in the image with a particular value. This axis scales with the data, and is not particularly important (other than to identify what's happening with a particular tone vis-à-vis others).

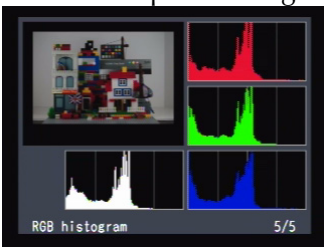
So what does a well-exposed image look like? It's actually easier to define what constitutes a poorly exposed image. Here are some things to watch for:

- *Most pixels skewed to the right of a histogram*. If a significant number of pixel values exist at the extreme right edge, it's likely the shot is overexposed or the channel blown out. Histograms that are "right-heavy" make it difficult to control highlight detail. Check the Highlights display to see *where* you've blown out highlight detail.



Spike at the extreme right and everything skewed to the far right? Overexposed! Note the washed out colors in the preview.

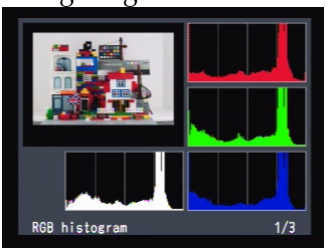
- *Most pixels skewed to the left of a histogram*. If a significant number of pixel values exist at the very left edge, it's likely the shot is underexposed or the channel has very little data in it (which happens in some types of light[81]). Histograms that are "left heavy" tend to have troublesome shadow detail. If there is also little or no exposure shown in the right side of the histogram, you need to add more exposure to the shot. Note that underexposed images are easier to recover detail from than overexposed images.



Everything skewed left and lots of unused histogram space at the right? Underexposed! Note the saturated bright colors (such as yellow), but also the lack of detail in the dark areas and how "drab" the overall look of the preview is.

[81] Incandescent light is usually low in Blue channel information, for example.

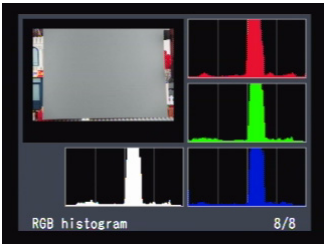
- *Pixels are scattered over the entire width of a histogram*. The overall image or channel is likely to be high in overall contrast. Consider varying the lighting, if possible; or consider using a **Tone Compensation** value higher than **Normal**. While a broadly scattered pattern in the histogram is okay, you might not be satisfied with color saturation or contrast of the final image. Consider[82] adding fill lighting in dark areas.



The big spike is the predominately white background, and the fact that this is not at the right edge of the histogram means that detail in it will print. At the other extreme, there's very little going off the left edge of the histogram (note that there are some small black blocks and black squares in the test charts, so if they're rendered correctly we should have a small spike at the left edge of the luminance histogram (which we do). In this example, the luminance histogram is virtually perfect. The Blue and Green channel histograms are also near perfect. Only the Red channel histogram has anything of concern in it (there's a very small spike at the right of the Red channel histogram, indicating that there's a tiny bit of Red channel blowout. Overall, I wouldn't be concerned with this histogram unless I knew that I needed to resolve fine detail in the bright reds, in which case I might use -0.3EV exposure compensation. Note that this would be a case of preserving highlight detail in the Red channel at the expense of shadow detail (more things will become black).

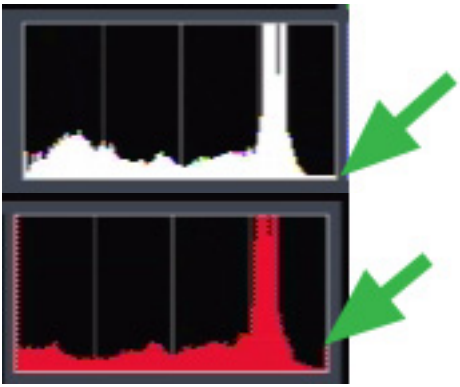
- *Pixels are mostly in a narrow band in a histogram*. The image is likely very low in contrast (or it could be monochromatic, as would be the case of taking a picture of a gray card). Consider using a **Tone Compensation** value lower than **Normal**.

[82] Just to be clear: when I use the word "consider" I mean consider, not "use." In other words, you wouldn't automatically dial in a different compensation, but you *might* do so if you don't wish to post process and have some experience in seeing how a compensation change impacts an image visually and that change is what you want.



*Here I've placed a big gray card in front of most of the scene. We expect to see a **lot** of the same gray values, and indeed we do see a big spike for them. That area of the scene would be very low in contrast. I've left a bit of the rest of the scene in the edges of the frame, and that's what is producing the two tails to either side of the spike. Note that overall, the histograms are just as wide as they were before (that scene behind the gray card is still a rather high contrast one), we just don't have many pixels of those outlying values any more.*

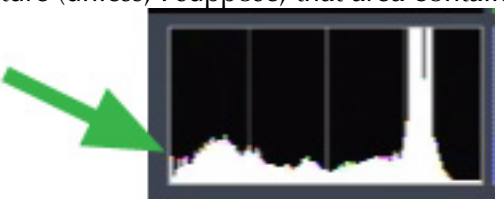
- *Any spike at the right edge means lost highlight detail.* This is probably the worst thing you can see in a histogram. The higher the line crawls up the right edge of the histogram frame, the more blown-out pixels you have in your image. What makes this bad is that our eyes immediately go to the brightest area of a photo when we view it, and all those pixels stacked up at the right edge of the histogram will eventually print as paper (yuck!). Worse still, a blown highlight in only one channel makes for real problems in post processing an image, as most software can't correctly adjust colors in highlight areas where one channel is blown out.



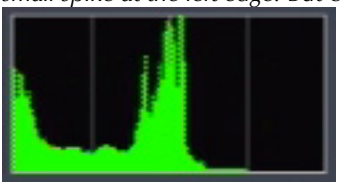
Compare the luminance histogram from that main scene (top) with the Red channel histogram (bottom). The luminance histogram does not show any spike at the right edge (i.e. the luminance channel is not blown out) while the Red channel has a short spike at the right edge

(look at the points of the green arrows). Luminance channel blow-out is bad, as it means you've lost significant detail in the highlights. Individual color channel blow-out ***can*** *be just as bad, as it means a loss of ability to render the correct color at those pixels, but sometimes you can ignore it. The primary red in this photo, for instance, is Lego blocks, which have no detail in them and already are pretty "nuclear" in color. In this case, I probably wouldn't worry much about the channel blow-out.*

- *Any spike at the left edge means lost shadow detail*. Or it could simply mean you have some totally black areas in your shot. Our eyes aren't bothered as much by dark areas in a picture (unless, I suppose, that area contains your subject).



This spike (green arrow) indicates that there are pixels that are going to record with no luminance in them (essentially, black). Unlike channel blow-outs, which you almost always avoid, black spikes are sometimes what you want. This particular scene has real blacks in it, so we'd expect to see a small spike at the left edge. But compare the above histogram to this one:



Here it should be clear that there are a lot of values stacked up against the left side of the histogram (and none in the right quarter), a clear indication of underexposure. That means that things that aren't black may be rendered as black, which we probably don't want. Remember, the size of the spikes give you some idea of how much of the image has that value. Big spikes at the left edge are usually not a sign of good exposure.

In general, you're looking for a moderately wide distribution of the pixel values in all four histograms, with the largest peaks for the important portions of your scene somewhere in the middle three-quarters of the range. If you're working in a scene that has many bright values (e.g., snow), the largest peaks may be to the right of the histograms. Likewise, if you're working in a scene that contains many dark values (e.g., unlit, shadow areas), the largest peaks may be to the left of the histograms. Either case is usually okay, as long as you

have a wide distribution of pixels and neither extreme runs off the *edge* of the histograms.

Note: Most users find it easier to "fix" dark images (e.g., increase shadow detail) than to fix bright images (e.g., "pull back" highlight detail). This is even true of NEF images, where you can apply "exposure compensation" after the fact. However, note that due to the way digital images are captured, noise is more prevalent in the "dark" areas of your image than it is in the bright areas[83]. Normally you don't see the noise as it is buried in very dark areas that print at or near black, but when you use post processing techniques to "boost" shadow areas in an image to correct exposure, you'll also be boosting noise, perhaps into visible range.

Note: Photoshop histograms are calculated a bit differently than those that the camera shows. One thing that confuses many NEF shooters is that Photoshop histograms default to only show the top 8 bits of data. If you use Capture NX to output 16-bit images to Photoshop, be aware of that!

I've already touched on this, but it bears repeating: why are channel histograms important? Remember those nuclear colors I mentioned earlier? Well, channel histograms would be the one tool on the camera that might alert you to the fact that you've got one. But even in some situations where you might not be expecting it, the channel histograms can save you from an exposure error.

The classic example for my type of photography is the red rock country of the US Southwest (Northern Arizona and Southern Utah, for example). If you take a picture of a landscape feature that's in bright sun, all that red in the rock has a tendency to push the Red channel up, often enough to

[83]Why? Because the signal to noise ratio for a pixel value of 1,1,1 is lower than one with a value of 254,254,254. Let's examine a hypothetical example to find out why. Say that your camera has random noise "base" that averages 2 photons. Further assume that the 1,1,1 value represents a photosite that's captured 100 photons. The signal to noise ratio for that pixel is 50:1. The 254,254,254 value represents capture of perhaps 10,000 photons, so the signal to noise ratio is 5000:1.

blow the channel out completely. This has an impact after the fact: when you go to post process that picture and perhaps try to alter the white balance a bit, the blown Red channel will prohibit you from many manipulations you might want to do, and the tonal ramp in the areas that have been blow out may be compromised.

Red rock isn't the only thing you have to watch out for, though, which is why you just have to pay attention to the channel histograms. Any Red or Blue channel blowout typically means you need to reduce exposure. Green channel blowouts are a little less problematic[84], but if you have a large expanse of green (like a lawn or a golf course) you still need to bring the tonal value down.

Exposure Modes

The D80 has four basic exposure modes plus seven Scene exposure modes. We'll deal with the basic ones first, because, as you'll soon discover, I'm not a fan of the Scene exposure modes.

P *Program*—In this exposure mode, the D80 automatically adjusts both the aperture and shutter speed to create a properly exposed image. The combination picked is based upon a predetermined table in the camera (see "Program Exposure Table" on page <239>). You may override the selection chosen by the camera by rotating the Rear Command dial (called *Flexible Program* by Nikon). **For most new-to-DSLR users, this is probably the exposure mode you should start with. It gives you "smart" automation backed with the flexibility to override. *Warning*: when you start using flash you'll want to avoid this exposure mode, though.**

A *Aperture-preferred*—You control and choose the aperture setting (using the Front Command dial) and the D80 automatically picks the correct shutter speed to create a

[84]That's because most color manipulations you'd make after the fact impact the blue and red channels more than the green, which is in the middle of the spectrum between the two.

properly exposed image. Note that the shutter speed the camera picks is incremented in 1/3 stops with the default camera settings in this mode. **As you get more serious about your photography you'll discover that the aperture you select has a great deal to do with what is in and out of focus. Most serious amateurs gravitate towards this exposure mode as they master concepts like depth of field. Many professionals use this exposure mode.**

S *Shutter-preferred*—You control and choose the shutter speed (using the Rear Command dial) and the D80 automatically picks the correct aperture to create a properly exposed image. The aperture chosen is incremented in 1/3 stops in this mode with the default camera settings. **When you shoot sports or other fast moving action, Shutter-priority exposure mode gives you the ability to set an action-stopping shutter speed and let the camera do the rest. Professionals who shoot sports tend to use this exposure mode.**

M *Manual*—You control and choose both aperture (Front Command dial) and shutter speed (Rear Command dial); the D80 advises you on exposure by activating an analog metering bar in the viewfinder and top LCD showing what your current choices would produce:

underexposure
correct exposure
overexposure

The number of bars indicate *how much* under or over exposed the camera thinks the image may be (in the default settings, as shown here, each bar is 1/3 of a stop, so the under and overexposures shown here are 1 1/3 stop—four bars from the center correct position). **Manual exposure mode gives you full control, much like the older "match-needle" cameras that were prevalent in the early days of SLRs. Many users gravitate to Manual exposure mode when they want to make sure that a particular combination of aperture and shutter speed is used (as when they meter off one area and compose in another). Some professionals use this exposure mode**

because it forces them to deal with both their aperture and shutter speed choice and can be a pragmatic way of "locking" exposure.

To select the exposure mode, turn the Mode dial on the top left of the camera so that the indicator for the exposure mode you wish to use is aligned with the white line on the side of the viewfinder prism. For the basic exposure modes, these indicators are displayed as **P**, **A**, **S**, or **M** (in the following photo, the Mode dial is set to **M**):

Flexible Program exposure mode

As noted earlier, the Program exposure mode uses a predetermined combination of aperture and shutter speed based upon how much light is in the scene and the maximum aperture of the lens. I call this the "program."

You can override the program by rotating the Rear Command dial when the meter is active. Note, however, that the overall exposure remains the same; in other words, if your override increases the shutter speed, the aperture is decreased, and vice versa. A small icon (P*) appears in the top LCD when you've overridden the camera's program settings. Note also that once you override the program, *it remains overridden* by that same amount until you change the exposure mode, turn the power switch to OFF, use the Rear Command dial until P* no longer appears, or perform a camera reset.

Program Exposure Table[85]

EV	<55mm lens	55-135mm lens	>135mm lens
0	f/1.4 @ 2s	f/1.4 @ 2s	f/1.4 @ 2s
1	f/1.4 @ 1s	f/1.4 @ 1s	f/1.4 @ 1s
2	f/1.4 @ 1/2	f/1.4 @ 1/2	f/1.4 @ 1/2
3	f/1.4 @ 1/4	f/1.4 @ 1/4	f/1.4 @ 1/4
4	f/1.4 @ 1/8	f/1.4 @ 1/8	f/1.4 @ 1/8
5	f/1.7 @ 1/10	f/1.4 @ 1/15	f/1.4 @ 1/15
6	f/2 @ 1/15	f/1.4 @ 1/30	f/1.4 @ 1/30
7	f/2.4 @ 1/23	f/1.7 @ 1/45	f/1.4 @ 1/60
8	f/2.8 @ 1/30	f/2 @ 1/60	f/1.4 @ 1/125
9	f/3.5 @ 1/45	f/2.4 @ 1/90	f/1.7 @ 1/180
10	f/4 @ 1/60	f/2.8 @ 1/125	f/2 @ 1/250
11	f/4.8 @ 1/90	f/3.5 @ 1/180	f/2.4 @ 1/350
12	f/5.6 @ 1/125	f/4 @ 1/250	f/2.8 @ 1/500
13	f/6.7 @ 1/180	f/4.8 @ 1/350	f/3.5 @ 1/750
14	f/8 @ 1/250	f/5.6 @ 1/500	f/4 @ 1/1000
15	f/9.5 @ 1/350	f/6.7 @ 1/750	f/4.8 @ 1/1500
16	f/11 @ 1/500	f/8 @ 1/1000	f/5.6 @ 1/2000
17*	f/13 @ 1/750	f/9.5 @ 1/1500	f/6.7 @ 1/3000
18*	f/16 @ 1/1000	f/11 @ 1/2000	f/8 @ 1/4000
19*	f/19 @ 1/1500	f/13 @ 1/3000	f/11 @ 1/4000
20*	f/22 @ 1/2000	f/16 @ 1/4000	f/16 @ 1/4000

** Not possible with matrix metering, as it exceeds the meter's brightness range; camera reverts to center weighted*

There are bunch of things to note in the above chart (it really is an important thing to study):

- The <55mm column is basically the same "program" that is used in the professional cameras (D200 and D2 series).
- If you're using consumer lenses on the D80 (e.g. the 18-135mm kit lens) many of the table values can't be reached! For example, at 135mm the kit lens is f/5.6, so until you get to EV 16 you're a bit stuck with the main program (the "program" will always pick f/5.6 and have to

[85]The Nikon manual is a bit misleading. The "ISO 200" specification in the Nikon manual references the extremes in EV the meter can handle and shouldn't be read to mean that this table changes at other ISO values. At other ISO values than 200, the meter may have different EV restrictions, but the "program" doesn't change for any given EV value.

compensate with setting a slower than usual shutter speed).

- The matrix metering system only extends out to 16.3 EV at ISO *200*, so some of the upper limits of the table won't be used with that metering method and may result in overexposure.
- While Nikon doesn't specifically say so, this table is also the underlying exposure assumption for all the Scene exposure modes, as well.

Students who've been to my workshops know that I'm not a fan of Program exposure mode. That's mostly because Program exposure mode has some hidden liabilities when using flash, but also because most users don't take the time to understand exactly how the camera is making its exposure decisions or even that once they've overridden the "program" it tends to stay overridden.

Don't be a "lazy" photographer and use Program exposure mode casually. If you're serious about controlling depth of field, camera shake, subject motion, and a host of other factors that come up while making photographs, get out of Program exposure mode and take more direct control over what the camera is doing.

Scene Exposure Modes

Nikon calls the additional, special exposure modes "Digital Vari-Program modes" in the D80 manual. I call them Scene exposure modes, a term that is in common use in the consumer point-and-shoot cameras and more fitting to the intended use: if you encounter a certain type of "scene," set the equivalent "Scene exposure mode."

These Scene exposure modes are similar to the Program exposure mode in that the camera makes all the decisions, but each varies the way in which Program exposure mode works. They also change a few image quality parameters and place limitations on the camera settings that can be made.

I'm not a big fan of the Scene exposure modes for several reasons:

- *The Scene exposure modes dramatically limit other camera settings you can make* (see the table at the end of this section). Essentially, they treat the camera user (you!) as an idiot that doesn't know what they're doing, so they "lock out" virtually all options. You get almost no ability to override the camera, and you'd better hope the camera gets the exposure right, because you don't get to control the metering method or override the selected exposure in any way. Ouch! Other examples: **Optimize Image** settings are set to something Nikon thought was appropriate for the subject, **White Balance** is set to **Auto**, and flash will be used automatically in low light (and set to balanced fill-flash mode).
- *None of the Scene exposure modes sets exactly what a professional would for the circumstance*; in essence, **none** of Nikon's choices make the kind of change a knowledgeable user would in each scenario.
- *The Scene exposure modes all have the liabilities of Program exposure mode*. When you use flash, those liabilities can become extremely problematic.
- *The Scene exposure modes set color spaces!* Auto, Portrait, Child, and Sports set Color Space 1a (sRGB); Landscape, Close Up, and Night Portrait set Color Space IIIa (enhanced sRGB). This makes getting a consistent color out of your camera more difficult.
- *All Scene exposure modes set Optimize settings*. Scene exposure modes set **Sharpness** and **Tone** to **Auto**, **Hue** to **0**, and **Saturation** to **Normal**. That's despite the fact that Nikon uses the words "vivid" in some of their Scene exposure mode descriptions. In particular, I find that the two **Auto** settings can be problematic, as they are sometimes over aggressive in what they set.
- *All Scene exposure modes set* **Auto ISO Sensitivity**. You have no control over the amount of noise the camera

produces because of this. If the camera wants ISO 1600, that's what it'll set.

That said, here's what the seven Scene exposure modes are and what they do:

Auto	This is what I call the "waiter mode." That's because the camera does *everything* automatically and doesn't allow the user to make any changes. In other words, put the camera in **Auto**, hand it to the waiter, tell him to press the big silver button…
Portrait	The primary change from the other Scene exposure modes is that the camera tends to select a physically larger aperture (e.g., f/4 instead of f/8). Optimization settings are "softened" a bit. The rationale behind this selection is to isolate the subject from the background with a shallow depth of field (large aperture) and to not highlight skin blemishes (optimization settings).
Landscape	Sort of the opposite of Portrait: smaller apertures are used (e.g., f/11 instead of f/5.6) and optimization settings are "punched up." Here the idea is to increase depth of field and use saturation to increase color impact. Flash is turned off and never used.
Close Up	The big change here is that the autofocus sensor used is the central sensor. Again, more vivid optimization settings are used, though it appears that Nikon chose to use a shallower depth-of-field than most professionals would select.
Sports	The camera tends to keep the shutter speed short (fast) in order to "stop" action. Surprisingly, the camera does *not* switch to

	Dynamic Area AF; instead it stays in Auto Area AF. Flash and the Autofocus Illumination lamp are disabled.
Night Landscape	Mostly the same as Landscape, but uses longer shutter speeds.
Night Portrait	Slow Sync is set so that long shutter speeds allow backgrounds to appear well exposed. This also means that you may get long shutter speeds, which is why you should consider using a tripod.

Things You Can't Set with Scene Exposure Modes

- White balance
- **Optimize Image**, including Color Space
- Metering Method
- Flexible Program
- Exposure Compensation
- Bracketing
- AF Assist (in Landscape, Night Landscape, and Sports)
- Flash Sync (in Landscape, Night Landscape, and Sports)
- Flash Exposure Compensation
- Internal Flash Mode
- Custom Settings #7, 11, 12, 13, 14, 15, 22, 23, 24, 25, and 26 (basically all that deal with exposure and flash)

When a Scene exposure mode overrides an existing camera setting that was previously made while using Program, Aperture-priority, Shutter-priority, or Manual exposure mode, that setting is restored when you return to those exposure modes.

The Bottom Line on Scene Exposure Modes

Avoid them. In virtually every case you'll eventually find that they limit you in some way that is important. Let's run through a better way of approaching the same things (some of these options we haven't discussed yet, but come back to this section once you've read the entire eBook):

Portrait

Use Aperture-priority exposure mode (**A**) and select the largest aperture (smallest number, as in f/2.8) you can. Focus on the eyes. In **Optimize Image** set a low **Sharpening** setting, set **Color Space Ia**, set **Tone Comp.** to **Normal** or **Medium Low**. Use flash for fill light (set -1.0 stop of *flash* exposure compensation with external flash in Standard TTL, if possible).

Landscape and Night Landscape

Use Aperture-priority exposure mode (**A**) and select a small aperture (largest number, as in f/22 [86]) you can. Use a hyperfocal distance table to set focus manually (see "Depth of Field" on page <349>). In **Optimize Image** set **Sharpening** to **High** or **Normal**, set **Color Space IIIa**, set **Tone Comp.** to **Normal** or **Medium Low**.

Sports

Use Shutter-priority exposure mode (**S**) and select a shutter speed appropriate to stop the action of the sport you're photographing (e.g. 1/500 for basketball). If you don't have a lens with a very "fast" aperture, you probably should turn on the **Auto ISO** function to maintain your shutter speed. Set CSM #3 to **AF-C**. In **Optimize Image** set **Sharpening** to **Normal**, set **Color Space Ia**, set **Tone Comp.** to **Normal**.

Close up

Use Aperture-priority exposure mode (**A**) and select a small aperture (e.g. f/16). Set CSM #3 to **AF-S**, or better yet, use manual focusing. In **Optimize Image** set **Sharpening** to **High** or **Normal**, set **Color Space IIIa**, set **Tone Comp.** to **Normal**. Use **Pre** White Balance and measure it off a gray card if you're shooting flowers and the exact color is important.

Night Portrait

Use Aperture-priority exposure mode (**A**) and select the largest aperture (smallest number, as in f/2.8) you can. Set

[86] However, note my comments about diffraction on page <353>.

Rear Sync in the Flash Options. Pop up and use the flash (you may have to set Flash Exposure Compensation to keep flash from looking too artificial and overwhelming; try -1.0 to -1.7EV in flash exposure compensation. In **Optimize Image** set **Sharpening** to **High** or **Normal**, set **Color Space Ia**, set **Tone Comp.** to **Normal** or **Medium Low**.

Now that wasn't so much to deal with was it? Basically, the Scene exposure modes are saving you three to five simple steps, and even then they don't get everything right. Plus you no longer have to worry about the built-in limitations if you use my method.

ISO Sensitivity

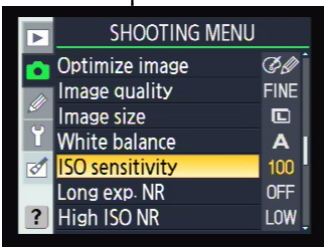
The D80 allows user controllable ISO values from 100 to 1600, in as little as one-third stop steps. The D80 also has settings of **H0.3**, **H0.7**, and **H1.0**, which are approximately equivalent to ISO 2000, 2500, and 3200 respectively. These last three values are not labeled with an ISO value because they're not finely calibrated and thus only approximate values[87].

To set ISO values on the D80:

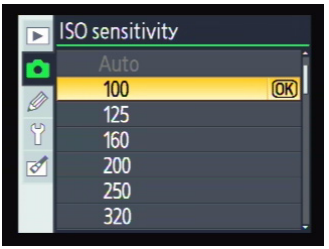
1. Press the **MENU** key to show the menu system.
2. Use the Direction pad to navigate to the SHOOTING menu (the camera icon tab).
3. Use the Direction pad to navigate to the **ISO Sensitivity** option and press the ▸ key on the

[87] As you'll see in the examples, noise starts to impact color intensity as you boost ISO value, and color intensity is something we would interpret as an exposure cue. Above ISO 1600, the color impacts of the noise are intense enough that you might not feel like you got the full benefit of the boost.

Direction pad or the **OK** button to select it.

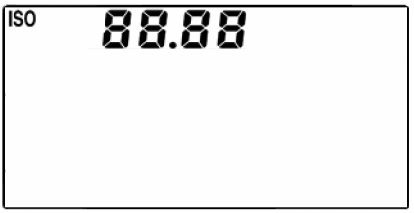


4. Use the Direction pad to select an ISO value and press the ▸ key on the Direction pad or the **OK** button to select it.



Alternatively: Hold down the **ISO** button and use the Rear Command dial to select an ISO value. (The color LCD must be off to do this.)

Top LCD:



While it may seem that you should simply set the camera to the highest ISO value and leave it there (or use the **Auto** function available in the Custom Settings), don't. As you increase the D80's ISO value, your images gain considerable digital noise. Much as using a higher ISO film in a 35mm film body results in increased visible grain, added digital noise makes an image look rougher (most noticeable in large areas of a single color). Worse still, digital noise added by the D80 is not truly random, as is film grain.

The D80 has a variety of noise reduction schemes, some of which work automatically, some of which are user controlled. **Long exp. NR** (on the SHOOTING menu) has nothing to do with ISO: it controls a type of noise that builds up when a sensor sits collecting light photons for long periods of time (8 seconds or longer on the D80).

High ISO NR (also on the SHOOTING menu) is a setting that *does* apply to noise caused by ISO settings. Because higher ISO values are caused by amplifying data, small inconsistencies in data are amplified as you increase the ISO setting. **High ISO NR** is a setting used to combat that; it begins working above ISO 400 if left to the default or turned on by you, but it always is always active in some form at above ISO 800. In table form:

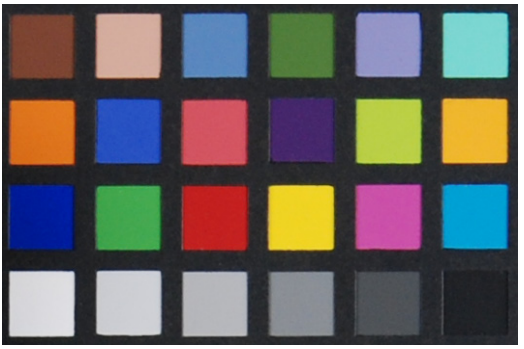
ISO	*High ISO NR Used?*
100	never
125	never
160	never
200	never
250	never
320	never
400	never
500	yes for **Normal**, **Low**, and **High**
640	yes for **Normal**, **Low**, and **High**
800	yes for **Normal**, **Low**, and **High**
1000	always (you select strength, default **Normal**)
1280	always (you select strength, default **Normal**)
1600	always (you select strength, default **Normal**)
HI0.3	always (you select strength, default **Normal**)
HI0.7	always (you select strength, default **Normal**)
HI1.0	always (you select strength, default **Normal**)

But noise reduction routines aren't perfect, and they also have a tendency to reduce edge definition.

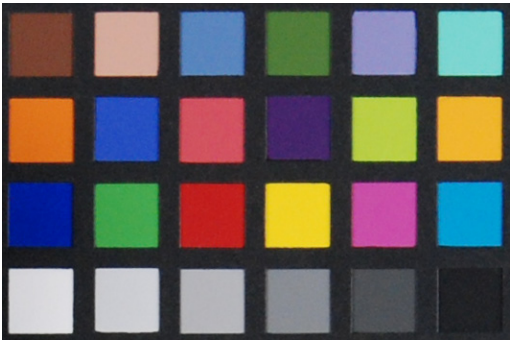
Note that the following samples (150% crops from the full test screen you saw earlier) are only a few of the ones I examined

to make my comments. Go by what I write, not necessarily by what you see.

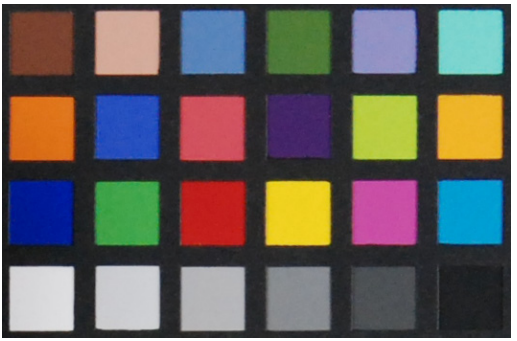
ISO 100. Look carefully at: (1) how well the resolution holds up; (2) whether broad color patches show any grain or unevenness; (3) whether hard edges are being "damaged"; and (4) are colors staying accurate and vibrant, even in the shadows.



ISO 200. Virtually no change from ISO 100.

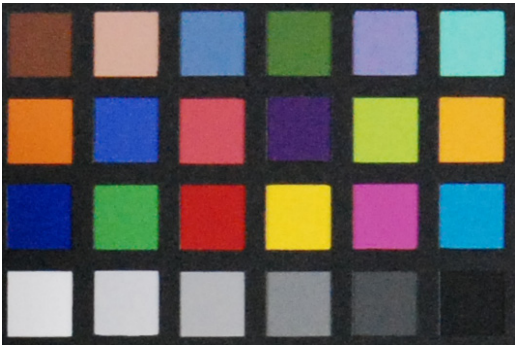


ISO 400. Still no real visible changes have occurred. If you look *very closely* at blocks of color and textures you'll see a bit of grain-like fuzz starting to appear.

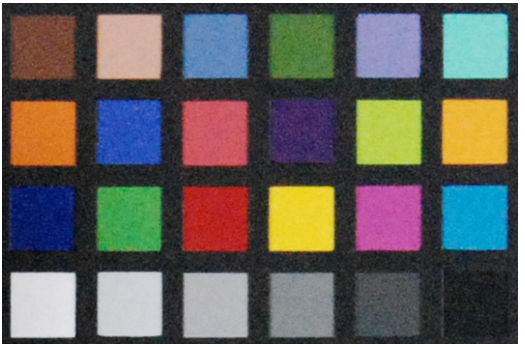


ISO 800. One clear improvement Nikon has made over earlier bodies (and competitor's bodies) is that color "punch" stays consistent at higher ISO values. With some cameras, as noise builds up, colors get darker and "muddier." Not really true of the D80. While we're seeing more roughness in the color patches (noise), colors are still highly saturated. Detail is holding

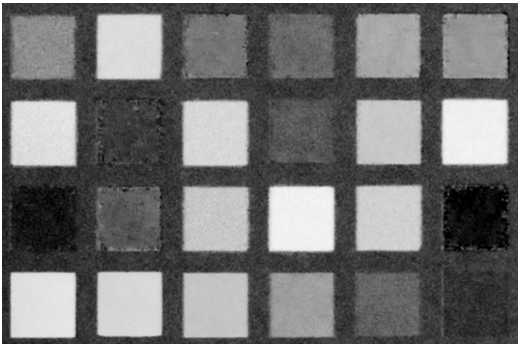
up well at ISO 800, as well; edges are still relatively clean.



ISO 1600
Probably the first ISO value at which most people would see any change at all. Some of the color patches have clear noise in them, and the purple patch is now starting to lose saturation. Still, detail and edges are not badly compromised, and this is quite a good result for ISO 1600 on any camera.



ISO 3200 (H1.0)
Now the noise should be obvious, and you should see the darker colors losing their saturation. The Red and Blue channels are the



big culprits (see second image for Red channel; note how there's lots of noise in the green and blue patches). Still, detail and edges are better than I'd expect. (Remember, built-in camera noise reduction is being applied in these images; you can't completely turn it off at ISO 3200.)

Note: Underexposing is a bit like setting a higher ISO. Some of the complaints I've heard from D80 users about "noisy, unsaturated images" can be attributed to this. For example, let's say you were shooting at ISO 200 but underexposed by two stops. Do your images look as if they were shot at ISO 800 when you run a correction on them in post processing? I'm betting that, yes, they do (and no in-camera noise reduction would have been run on it!). Just like with the D2xs and D200, I see an almost direct one-to-one correlation between results from underexposure and higher ISO use on the D80.

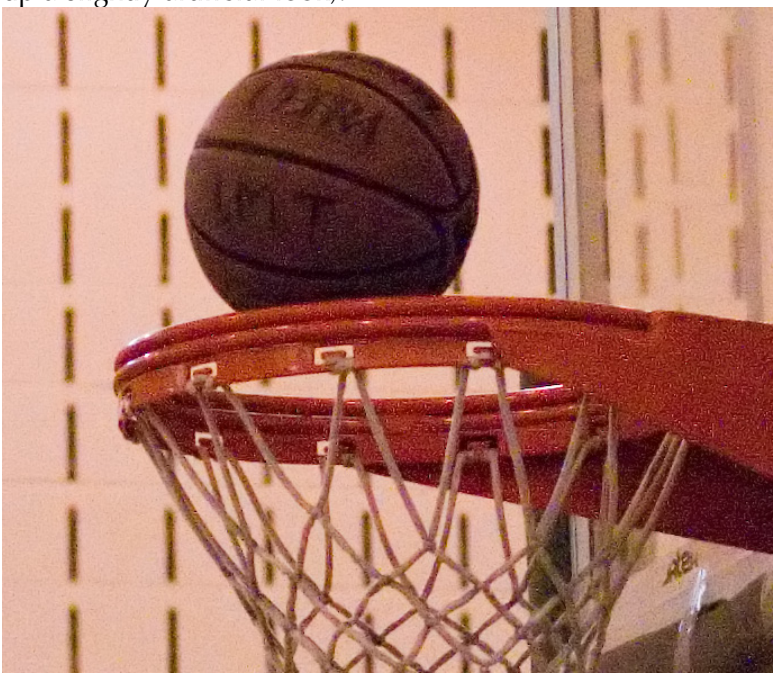
Remember, as you increase ISO to the highest levels you'll find that colors tend to lose a bit of their punch (e.g. get

"muddy"), and overall contrast goes down. At the extreme, it can result in the equivalent of a 2-bit or higher reduction in individual color values, which is easily seen in images. **H1.0** very obviously loses color saturation, but the effects begin as early as ISO 800.

When the D200 and D2x appeared, I was asked many times about whether it was usable for indoor sports. As I did with both those cameras, I decided to test the question with the D80, as well. During one of my weekly basketball games, I brought my D80 and set it to essentially the worst possible scenario (NEF image to get rid of all noise reduction, one stop underexposed, **Auto** white balance in a mixed lighting situation, **H1.0** ISO, high sharpness setting). Here's a small area cropped from the image run straight through Capture NX (no modifications):

Yes, there's plenty of noise clearly evident, but it's quite "usable" noise and free from a lot of the false coloration and the patterned common to digital cameras. With the noise

slightly reduced by running Neat Image non-aggressively, you may be able to see that the edges and tonal ramps still have a bit of "grit" to them, but otherwise things look pretty good (look at the edges of the ball and rim, though; they've picked up a slightly artificial look):



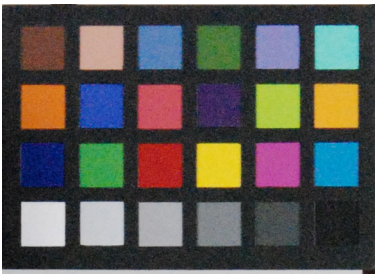
The thing to note is that edges and detail really haven't been *destroyed* in this worst case scenario as they often are by digital cameras set to high ISO values (remember, you're looking at a small crop from the center of the image—I was standing on the sidelines shooting with a ~50mm lens). Had I exposed correctly, used JPEG with in-camera noise reduction, and post processed the color a bit to restore some of the saturation, the result would be quite usable. That's not to say it would be perfect or that you couldn't see some noise or color loss, but I think the images would hold up decently in 8x10" prints.

Noise Reduction Settings

As mentioned, the D80 has two noise reduction abilities built in:

- **Long exp. NR**—performs a dark frame subtraction on long exposures to remove hot pixels (photosites where the data values get "stuck"). Surprisingly, this is a relatively necessary function on the D80, as it produces hot pixels easily. You should probably leave this option **On** (it only applies to exposures over 8 seconds[88]).
- **High ISO NR**—performs in-camera noise reduction on images taken above ISO 400. The manual and menu system seem a little out of sync with one another here. **Off** means no noise reduction is applied at ISO 500 through 800, but a minimal amount is applied at ISO 1000 through H1.0. **On (Normal)** means a minimal amount is applied at ISO 500 through 800 and a moderate amount at ISO 1000 through H1.0. **On (High)** means a moderate amount is applied at ISO 500 through 800 and a large amount is applied at ISO 1000 through H1.0.

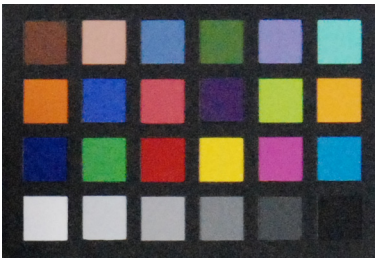
Since this is apropos to a discussion of ISO, let's look at how noise reduction fares at the highest ISO value, **H1.0**.



Here's **High ISO NR** set to **Off** at ISO **H1.0**. (Remember, the camera always applies some noise reduction at this ISO value). You should see clear grain-like structures in most of the color patches.

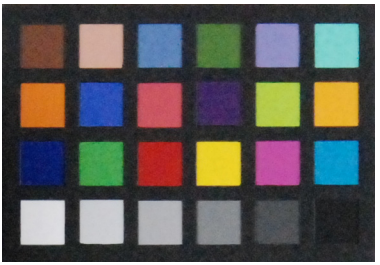
[88] In my opinion, Nikon goofed here. The D80 produces hot pixels with shorter exposures than that, but there's no automated way of removing them because the **Long exp. NR** doesn't kick in until you take an 8 second exposure.

Here's **High ISO NR** set to **On (Low)** at ISO **H1.0**. Note the background behind the parrot (this is at 175% view). The worst of the grain-like noise is starting to disappear, but it still has some false color in it (you should see some purple/red in the light blue).



Here's **High ISO NR** set to **On (Normal)** at ISO **H1.0**. Again a small, modest improvement occurs. Here, the background is starting to lose the false color information. But you might also sense that the edges are starting to lose

just a hint of their definition. I see this most on the edges in the barrels (the indents don't quite seem as "crisp").



Here's **High ISO NR** set to **On (High)** at ISO **H1.0**. The grain-like noise is almost gone, but you might also feel like the parrot and barrels are starting to look a bit "soft" (aliased). A careful sharpening (bottom) can restore some of the edges, but note that we'll pick some grain-like noise back up when we do this. Nevertheless, the D80 has a usable ISO 3200 equivalent, even with the noise reduction turned up all the way. Normally, high levels of noise reduction totally destroy edges and create a watercolor-like vagueness to detail. Nikon's implementation avoids this and gives you a workable solution for very low light conditions.

Overall, my assessment is that the in-camera noise reduction works decently. Still, it should be a last resort: use it only if you really can't afford to have the grain-like noise effect in your images and can afford to lose a little bit of detail. The D80 is a camera where I don't mind using the in-camera noise reduction (normally I run post processing noise reduction on images from my other Nikon cameras at high ISO values).

Automatic ISO

The **ISO AUTO** option[89] (see "Custom Setting #7 -- Automatic ISO Setting" on page <403>) tends to be misunderstood by virtually all users; it does not operate quite as you'd expect and has definite limitations. What happens when Automatic ISO is active depends upon what exposure mode you're using:

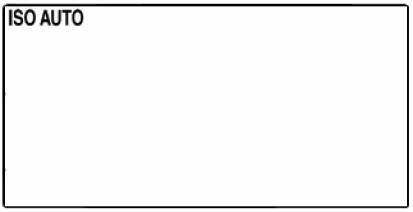
- In Manual exposure mode, the ISO is changed if the shutter speed and aperture combination you pick won't achieve a proper exposure (manual exposure bar centered at 0: ▪▪▪). For example, if you were at ISO 200 and set f/8 at 1/125 but the meter thought the exposure should be f/5.6 at 1/125, the camera will boost the ISO one stop to 400 (f/8 is one stop underexposed compared to f/5.6 in this example).
- In Shutter-priority exposure mode, the ISO is changed when the camera runs out of aperture range to use. For instance, assume that the initial ISO value is 200 and the aperture set by the camera to the lens' maximum of f/2.8. If the lighting changes such that f/2 is required, the ISO will be boosted one stop to 400 (f/2.8 is one stop underexposed compared to f/2 in this example).

[89] Yes, the modifier is behind the noun in Nikon's nomenclature. I prefer "Automatic ISO" and will use that in my descriptions, but will refer to the actual setting by the name Nikon uses in the menu settings.

- In Program (including the Scene exposure modes) and Aperture-priority exposure modes, ISO isn't changed until the exposure reaches the extreme at either end of the shutter speed range (1/30 second at the bottom end unless you set a different value with **Min shutter speed** in Custom Setting #7); the upper limit is always 1/4000). As long as the camera will set a shutter speed between those two extremes, the ISO value won't change.
- In *all* exposure modes the ISO sensitivity will never be set higher than the value you set in **Max sensitivity** in Custom Setting #7.

One nice touch is that last item: you can set the maximum ISO value (between 200 and 1600) for the camera to use when Automatic ISO is active. Plus the camera sets the ISO value in sixth stop increments when this feature is active. Another nice touch is that the D80 can show the ISO value being used in the viewfinder when you press the **FUNC** button (if you set Custom Setting #16 to **ISO display**). The Top LCD only shows the **ISO-AUTO** indicator:

Top LCD:



Note: If you use flash, Auto ISO turns off and your previously set ISO is used! The **ISO AUTO** *in the viewfinder stays lit (does not blink). This is Nikon's subtle reminder that "more light" is better than "higher ISO."*

To activate the Automatic ISO option, see the instructions for Custom Setting #7 on page <403>.

My recommendation about automatic ISO is this: you can set it on your camera with a maximum automatic value of ISO 400 and probably never notice any real change of image

quality for most types of shooting. You need to think more carefully about using it with higher maximum ISO values, and you should also consider what you have set your noise reduction settings to before cranking Auto ISO higher than ISO 400. You also need to learn when the camera will bump the ISO, so read about those exposure mode differences earlier in this section and make sure you fully understand them.

How ISO Values are Created

You might wonder how higher ISO values are generated by the camera. All ISO values above 100 are created by amplifying the data coming into the Analog-to-Digital converter. In other words, the sensor always works at the 100 sensitivity, but underexposed data values coming from the photosites are boosted by an amplifier to produce the higher ISO values.

As you might guess, this means minor differences between photosites get magnified and may become visible. Imagine a photosite that captures 150 light photons and an adjacent one that receives 155 photons. This difference is insignificant when these are black values and end up getting interpolated into, say, a pixel value of 10,10,10 versus 10,11,10. But if these values are being amplified several times and now represent middle gray values, the difference may be significant and visible.

ISO Operating Suggestions

To optimize image quality, follow these guidelines for setting ISO values:

- *Use the lowest ISO setting (100) whenever possible*. If you suspect that the scene you're photographing might produce moiré, use only the lowest ISO value—once noise gets interlocked with moiré, both become very difficult to remove.
- *Expose to the right*. Underexposure can generate additional noise issues with the D80, especially with slow

shutter speeds and ISO 1600. Keep your exposure histograms pushed toward the highlights (but don't blow out highlights by going too far and pushing the histogram data off the right edge). Indeed, the minimum amount of noise for a low contrast, gray target would be generated by overexposing the gray target so that the histogram spike was well right of center, then using Capture NX or Photoshop to re-center the exposure (Curves, Gamma, Exposure Compensation, etc.). What you generally don't want to do on a D80 is to fail to use the full range of the histogram to the right of center (i.e. underexpose).

- *ISO 200 and ISO 400 are actually quite close to 100 in quality, so don't be afraid to use them.* Normally you don't want to give up any image quality at all, but the very slight increase in noise at ISO 200 or ISO 400 isn't worth agonizing over: if it allows you to capture what you need to, use it! Indeed, using ISO 400 is a better choice than underexposing ISO 100.
- *Use ISO 800 in a pinch*, but expect a minor loss of color saturation and some visible noise in large color blocks, such as skies. The latter may require a bit of touchup using a software noise reduction tool such as Noise Ninja, dFine, or Neat Image (or consider setting the camera's noise reduction option). ISO 800 properly exposed is an obviously better choice than ISO 400 underexposed, by the way—at this ISO level, underexposure will start showing significant noise in shadows that you don't see at lower ISO values.
- *Use 1600 if you have to*, but you'll almost always want to have noise reduction set aggressively and perform some post processing sharpening (don't set sharpening higher in the camera—you'll be working at cross purposes by setting dueling in-camera settings). You may also need to perform some slight color correction and contrast adjustments on your ISO 1600 images, though these would still be minor adjustments.
- *Avoid ISO H0.3 to H1.0 if you can.* There's too much noise at these settings to make them useful for *general* shooting. These settings are usable in extreme lighting, but

realize that edge definition and resolution is seriously compromised and you very well may need to run serious post processing on such images.

- *Use higher ISO before longer shutter speed.* This is counter to my advice with other Nikon DSLRs. Because of the tendency to produce hot pixels and amp noise at long shutter speeds, I recommend boosting ISO rather than lengthening shutter speeds, at least up to 8 seconds, at which point you can use **Long exp. NR** to reduce hot pixels.
- *Set the Automatic ISO option to* **Max sensitivity** *of* **400**. The D80 is generally good enough at all ISO values up to 400 to leave Automatic ISO on, should you so desire (you certainly could leave it set to ISO 200 with no concern at all). Increase the value of this option only if you need the extra shutter speed (as in sports photography), and then only to the lowest possible level that achieves your objective (e.g., 1/500 shutter speeds for sports).

Tip: *For noisy NEF images taken at high ISO values, try using Nikon Capture NX to convert the image to 16-bit TIFF. Use the* **Noise Reduction** *function on the* **Adjust** *menu with a low value for* **Intensity** *and vary the* **Sharpness** *setting to restore detail.*

- *Avoid shutter speeds longer than 1/60 at ISO 1600.* Amp noise can begin to show up in the top central portion of the frame at these settings. It may not always be visible, but it is lurking under the exposure and can be revealed if you have to post process that portion of your image. If you can't avoid using slow shutter speeds at ISO 1600, frame loosely at the top and crop your image in post processing to remove the offending area.

Additional ISO-related suggestions:

- *Large prints require lower ISO.* If you're going to use an image for printing large prints (11x14 inches or bigger), try to use only the lowest ISO values.
- *Conversely, small work allows higher ISO.* If your work is to be used at small print sizes (5x7 inches or smaller), you

can probably work at up to ISO 800 (and even 1600) with relative impunity. I routinely get good looking ISO 1600 prints off my 4x6" PictBridge printer without any noise reduction or other adjustments. Still, the higher the ISO value you use, the more likely you'll spend significant time performing image correction, especially as you go up in print size.

- *¼ size usually allows any ISO up to 1600 (hint: use* **JPEG Fine Small***).* If you're going to use the photo at smaller than captured sizes (e.g. for Web or computer display), you can probably use any of the ISO values. When you reduce the image from full resolution to a smaller image size, you'll often find that some of the noise pattern disappears (especially true if you get to 1/4 size or 1/8 size). Plus, you'll have far fewer pixels to correct if you do need to fix something. Color saturation is still a minor problem at the higher ISO values, though.
- *Noise from higher ISO values in NEF images will be higher than in JPEGs*. The in-camera noise reduction routines aren't applied to NEF image data. I don't find that to be an issue, as I prefer post processing noise reduction when processing NEF files, anyway.

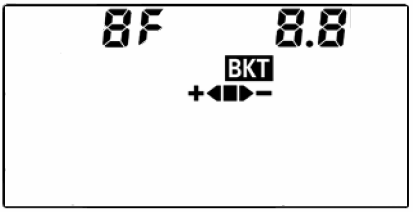
Exposure Bracketing

Obtaining correct exposures is important in digital work, as any overexposure kills highlight detail, while significant underexposure tends to mask (hide) shadow detail and produce noise. The D80's exposure meter, while quite good, isn't perfect, so some photographers like to bracket their exposures (i.e. take multiple exposures at slightly different settings).

The D80 has a flexible bracketing system, allowing between two or three exposures to be taken at 1/3 stop to 2 stop intervals (1/2 stop to 2 stop if Custom Setting #10 is set to **1/2 stop**). The D80 also allows you to set white balance bracketing instead of exposure bracketing (both can't be set simultaneously).

To turn bracketing ON:

1. Hold down the BKT button while rotating the Rear Command dial until BKT appears in the top LCD. When this icon is displayed, exposure bracketing is active. The Rear Command dial controls how many images will be in the bracketing sequence (2F and 3F are 2 and 3 images bracketed around the correct exposure). Note that you may set -2F and +2F, which are special bracketing variants not centered on the correct exposure (see chart, below).
2. Tell the camera what intervals to bracket by holding down the BKT button and rotating the Front Command dial until the top LCD displays your selection (0.3, 0.7, 1.0, 1.3, 1.7, and 2.0 at the camera defaults).



Top LCD:
(Left indicator is number of frames, right indicator is the exposure step)

Turning bracketing OFF is easy: simply repeat Step 1, above, but rotate the Rear Command dial until BKT no longer appears (a value of 0F).

D80 Exposure Bracketing Values Table (Exposures)

Top LCD	*Total Shots*	*Exposures**
- 2F 0.3	2	0, -0.3 EV
- 2F 0.5	2	0, -0.5 EV
- 2F 0.7	2	0, -0.7 EV
- 2F 1.0	2	0, -1 EV
- 2F 1.3	2	0, -1.3 EV
- 2F 1.5	2	0, -1.5 EV
- 2F 1.7	2	0, -1.7 EV
- 2F 2.0	2	0, -2 EV
+ 2F 0.3	2	0, +0.3 EV

+ 2F 0.5	2	0, +0.5 EV
+ 2F 0.7	2	0, +0.7 EV
+ 2F 1.0	2	0, +1 EV
+ 2F 1.3	2	0, +1.3 EV
+ 2F 1.5	2	0, +1.5 EV
+ 2F 1.7	2	0, +1.7 EV
+ 2F 2.0	2	0, +2 EV
3F 0.3	3	0, -0.3, +0.3 EV
3F 0.5	3	0, -0.5, +0.5 EV
3F 0.7	3	0, -0.7, +0.7 EV
3F 1.0	3	0, -1, +1 EV
3F 1.3	3	0, -1.3, +1.3 EV
3F 1.5	3	0, -1.5, +1.5 EV
3F 1.7	3	0, -1.7, +1.7 EV
3F 2.0	3	0, -2, +2 EV

** Nikon rounds third stop settings to* **.3** *and* **.7** *(they should actually be .333… and .666…). Also, half stop settings (e.g.* **0.5***) are only available if the Custom Setting #10 is set to ½ stop values.*

Note: The order in which the photographs are taken is normally as shown (e.g. correct value, followed by other values from negative to positive, in increasing order). You may change the order using Custom Setting #14 (see page <417>).

Other Custom Settings make changes to bracketing, as well. Custom Setting #13 (see page <415>) allows you to pick what is being bracketed (the default is that both ambient and flash exposures are varied during bracketing).

The D80 has more bracketing options than most photographers tend to use. Because the D80's meter is accurate, the most commonly used bracketing value is probably **3F 0.3** (or **3F 0.5** if you've set the camera for half stop values).

In very bright snow or sand conditions, I tend to set **3F 0.7** or **3F 1.0** *and* an exposure compensation value of +0.7 or +1.0 EV, as the Nikon metering system is often fooled into underexposing in those conditions. By setting exposure compensation, I move the bracketing midpoint from the

metered value. (I end up with exposures of +0, +0.7 and +1.3 or +0, +1, and +2.)

When bracketing is active, a quick peek at the Bracketing Progress indicators on the top LCD tells you exactly which images you still have to take:

Indicator	*Images Remaining to be taken*
+▬▬▬-	Normal, under, and over
+▬ ▬-	Under, over
+▬	Over

Other options exist, but if you understand the above, you should be able to figure them out.

If you've set a three shot sequence and see +▬▬▬-, you know that you're at the start of a new bracketing series. Any other indicator would tell you that you're in the middle of a sequence. (This doesn't apply to white balance bracketing, which always takes a full sequence with each shutter press. See "White Balance" on page <272>.)

One very useful potential of the bracketing system is to increase the dynamic range of your finished shots. Landscape and nature photographers like me often have a difficult time balancing the exposure for distant objects and the sky against foreground objects that may be in shadow. With film, we used graduated neutral density filters in such situations, but since we're going to be working with our D80 images in an image editing program such as Photoshop, anyway, why not go ahead and use different exposures for different parts of the scene? Here's the bare outline of the steps needed:

1. In the field, set your D80 to **3F 2.0** bracketing. In theory, this provides us another two stops of detail in the shadows and another two stops of detail in the highlights of our final shot when we combine the images later.
2. You need to make sure that neither the focus point nor the aperture changes between shots. The easiest way to do this is to use manual focus and Manual exposure

mode. Also, be careful that zoom lenses don't shift focal length during the bracketing sequence. (You may also want to make sure **Tone Compensation** and other **Optimize Image** controls aren't set to **Auto**, as the camera may vary those settings between shots.)

3. With your camera on a tripod, take the bracketed sequence of pictures.
4. In Photoshop, open the three images and place them into three different layers of a new image (sometimes I take a shortcut and just use the two extreme exposures). Use Photoshop's layering tools to control which parts of each exposure are used in the final image.

Obviously, this technique works best if you have a sharp delineation between the shadow and lit areas of a scene, or have areas with little or no interesting detail in which to hide transitions between the exposures. How good your resulting image looks is in large part attributable to your Photoshop skills, but I've seen some remarkable images created this way, images that would be very difficult to duplicate with film.

Better still, with version CS2 of Photoshop, use the D80's bracketing sequence to create images for Photoshop's **Merge to HDR** function. This new ability *automatically* merges multiple shots taken at different exposures into a single image with a potentially massive dynamic range. A few caveats apply:

- You need to bracket using shutter speed (changing aperture would cause focus differences). Thus, make sure your camera is set to Aperture-priority or Manual exposure mode before bracketing.
- You should normally take at least five photos for Photoshop's HDR function, but with the D80 you can only bracket three at a time. Try as your bracketing setting, but you may want to manually take five shots one stop apart instead.

- Focus should be set to a specific point (manual focus), Automatic ISO should not be used, avoid **Auto** white balance, the camera should be on a tripod, and all camera settings other than shutter speed should not vary between shots.

Assuming you pay attention to these details, you'll get astonishing tonal ramps and even any residual digital noise will tend to disappear (this is most noticeable in shadow detail, which tends to be impeccable using this method). Indeed, the combination is so good that I recommend that Fine Art photographers shooting for large prints use Photoshop's **Merge to HDR** and five or seven shot NEF bracket sequences[90].

When your camera is set to bracket, a few details sometimes catch new D80 users by surprise:

- In the Continuous frame shooting method, holding down the shutter release usually only takes the specified number of photos in the bracketing sequence (i.e. either 2 or 3). The camera automatically stops at the end of the bracketing sequence, regardless of whether you continue to hold the shutter release down.
- In the Single frame shooting method, you must press the shutter release once for each picture in the bracketing series. If you turn the camera **Off** in the middle of a series, it remembers that when you turn it back **On** (i.e. you're still in the middle of a bracketing sequence, no matter how long an interval has transpired). The same thing is true if your Secure Digital card fills up in the middle of a sequence: replace the card and the next picture picks up the bracketing sequence where it left off.
- Remember that exposure compensation interacts with bracketing values. If you set exposure compensation to –

[90] A number of other programs that perform the same function exist. I personally use Autopano Pro to do the same thing. I mention Photoshop's function because most digital SLR users end up with Photoshop and thus can experiment with high dynamic range shots without any further investment.

0.3 EV and a bracketing sequence of **3F 0.7**, you'd get shots of -0.3, –1, and +0.3 EV, not 0, -0.7, and +0.7 EV.

- When you set bracketing to **On** with the camera in manual (M) exposure mode, by default the D80 changes shutter speeds to accomplish the various exposures, despite your having set a particular shutter speed!

Nikon only mentions flash bracketing in passing in their manuals, and the way they describe the interaction with exposure bracketing confuses many new Nikon users. If you have a Speedlight attached and turned on when exposure bracketing is set, not only does the camera set different ambient exposure values for each shot, but it varies the output of the Speedlight, as well (remember, the default flash mode is a "balanced" mode, where flash doesn't assume that it is providing the main exposure). Normally, this is what you want the camera to do. You can tell the camera to use flash-only or camera-only bracketing by using Custom Setting #13 (see "Exposure Bracketing Method" on page <415>).

Pay careful attention to the top LCD when setting bracketing. If there are decimals in the values (e.g. **0.3** or **1.0**), then you're setting exposure bracketing. If no decimals appear (e.g. you see only **1**, **2**, or **3**), then you're setting white balance bracketing!

Note: If you shoot in NEF format, Nikon Capture NX allows a range of after-the-fact "exposure" adjustment (as do most raw file converters). You can actually save space on your Secure Digital card by simply shooting in NEF format and adjusting the image's "exposure" on your computer instead of bracketing a JPEG three-frame sequence. This is especially true if you make sure that your exposure doesn't have any histogram that extends off the right side of the display (i.e. no blown highlights). However, remember this is not exactly the same as changing exposure; what you change with Capture NX's "exposure" adjustment is the linearity of the data. Still, for errors of less than a stop, this is a useful shortcut and a real butt-saver if you weren't paying attention while shooting. Beyond -1EV compensation in Capture NX, you'll almost certainly get posterization of highlight data, while beyond +1EV you'll begin pulling up

visible noise. One final comment: Photoshop's raw converter seems better at dealing with extreme highlight detail via exposure adjustment than does Capture NX. If you're having problems at the extremes of the exposure, try using Photoshop to convert the image. Still, my photography mentors said it perfectly: "everything you get right in the field saves you time and effort in the darkroom." That's true of even the digital darkroom.

Exposure Compensation

The D80's exposure meter, like all modern meters, is set to assume that the subject it is looking at has a reflectivity of middle gray.

Camera meters are calibrated to ANSI standards, which use luminance targets (lights), not reflective targets (walls or gray cards). Plus there's an almost half stop tolerance allowed in the manufacturing standards. So your meter may be a bit off from what you expect it to register, though my experience with dozens of Nikon bodies has rarely indicated any deviation between bodies, let alone one big enough that I felt compelled to adjust exposure values to compensate for a meter inaccuracy.

Obviously, not everything you photograph is middle gray. Snow, for example, is obviously brighter (near 100% reflectance), and coal in an unlit underground mine is dramatically darker (near 0% reflectance). Without exposure compensation, large expanses of white snow or black coal would both appear gray in your photos. That's because the meter thinks the world is middle gray and tries to match everything to that value.

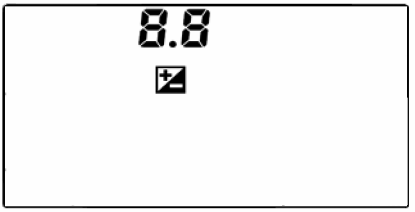
Virtually every professional I've met has his or her own method of deciding when to override the camera's meter, but every pro I know also does so with regularity[91]. Fortunately,

[91] As you might expect, I have my own method of dealing with exposure. Since this isn't a book on photography basics, I won't elaborate on it here other than to say that with digital cameras you have all the information you need to make excellent

it's quite simple to do, and Nikon has been good about keeping the exposure compensation control in the same location on most of their recent camera bodies, whether they are film or digital.

To set compensation hold the ± button on the top right side of the camera and rotate the Rear Command dial until the value you want is shown in the top LCD. You can also see the value while looking through the viewfinder.

Top LCD:



Note: Choose the exposure compensation increment (third, half, or full stops[92]) with Custom Setting #10 (see page <412>).

Once set, exposure compensation remains set until you use the control again and set a value of **0.0**.

Note: In Manual exposure mode, exposure compensation is "invisible": the zero point for metering is moved when exposure compensation is set. Try it. Set a correct exposure in Manual exposure mode and then dial in compensation: you'll see that the manual exposure indicator moves off of 0 in direct relationship to how much compensation you dialed in.

The D80 supports an alternate method of setting exposure compensation via Custom Setting #11; see "Exposure Compensation Control" on page <412>. When you set this

exposure decisions using the histograms. See "How to Interpret Histograms" on page <230> if you'd like more.

[92]Half stops are shown in a series like this: 0.0, 0.5, 1.0, 1.5, 2.0, and so on. Third stops are always rounded and are shown as 0.0, 0.3, 0.7, 1.0, 1.3, 1.7, 2.0, and so on.

alternate method, called "Easy Exposure Compensation" by Nikon, one of the command dials on the camera is used to adjust compensation values, *even when the ± button is not held down*! (*Which* dial is used depends upon your exposure mode and the value of Custom Setting #15!) Frankly, I think this is a dangerous ability because if you forget that you have it set, you may not notice that you're setting compensation instead of apertures or shutter speeds.

Some D80 users do find the Easy Exposure Compensation function useful, though, because they always shoot in one exposure mode (usually Aperture-preferred) and it gives them a convenient way to quickly take an exposure at a value different from the metered one (i.e. take a picture, twirl a Command dial (usually Rear, as the aperture is controlled by the Front), take another picture at the compensated setting).

White Balance

All light is not created equal. The perceived color of an object depends upon the light source that illuminates it. Our brains, however, are pretty good at overriding what our eyes see. If someone wearing a white shirt walks from the sun into the shade (where the light is usually "bluer" due to reflections and light scatter), our brain knows that shirt itself isn't getting bluer, even though the light being reflected by the shirt is now reflecting a bluer light. Essentially, our brain forces us to think of that shirt as a *constant* white value, regardless of how it is lit[93].

Unfortunately, both film and digital cameras respond to light in a fixed fashion, so the resulting image taken with a camera *will* reveal the shirt to be a bluish white in shade and a bright, neutral white in the sun.

[93] Okay, an *extreme* light might register, at least momentarily. For example, at Halloween I might place a bright green filter on my doorway lighting to make me "look ghoulish," but it's surprising how much our brain will still try to compensate. If you stand there looking at me long enough, your brain will start filtering out that extreme green light.

Color temperature is an objective measurement that defines the temperature at which a "black body" object would have to be heated to radiate light in the same wavelengths. Color temperature—the color of light—is expressed in units of Kelvin. Though it measures temperature, units of Kelvin do not get a degree mark, just a K (e.g. 5200K, not 5200°K). Lower numbers indicate a "redder" light (to our eyes), higher numbers indicate bluer light. The light itself isn't "red," it just has more red wavelength components than, say, a "bluer" light (which would have more blue wavelength components).

On digital cameras, you set a "white balance" to adjust the sensor to the wavelengths of light being captured. D80's have nine basic white balance settings:

AUTO or **A**	Automatic white balance. Nikon claims that this function works at any color temperature between 3500K and 8000K. Note that most indoor lighting falls *below* that range! Moreover, my experience tells me that the D80 gets less accurate towards the extremes, especially at the low Kelvin end (2000-4500K). I'd say the most accurate range is much narrower, perhaps 4500 to 6500K.
☀	Indoor shots using incandescent light bulbs (3000K)
▦	Indoor shots using fluorescent lighting (4200K)
☀	Outdoor shots in direct sunlight (5200K)
ϟ	Indoor or outdoor shots lit primarily by flash (5400K)
☁	Outdoor shots in overcast skies (6000K)
⌂	Outdoor shots taken in shaded areas (8000K)
PRE	Manually set white balance using a white or neutral object (Nikon doesn't specify a range, but we know that you can manually adjust a D80 from 2500K to 9900K, so the range should be at least that wide)

K Individual Kelvin values can be set

Note: Digital cameras fare less well using the Automatic white balance setting with light that falls under 4000K (note that Nikon doesn't recommend **Auto** *below 3500K for the D80; yet I find that even at 4500K the camera tends to set a white balance that's a bit too high in Kelvin for the light). That's partially because the blue sensors receive very little information at these so-called "warm" color temperatures, so the minute amount of blue wavelengths being seen by the sensor becomes a factor.*

One novel way of coping with the problem of getting good automatic white balance with indoor light is to simply imitate what we used to do with film: use an 80B filter! The 80B shifts the 2900K color temperature of a 100-watt bulb up to about 4300-4400K (an 80A would push it above 5000K), putting it within the range the camera handles well.

Tip: Nikon's choice for normal outdoor lighting (5200K) should raise eyebrows, though I haven't seen anyone specifically comment on it. Daylight film is usually balanced to 5400K, and many digital photographers set their default daylight value even higher. (The origin of the 5400K number, by the way, is interesting—it's the average measurement of color temperature, taken at noon on summer and winter solstice on the Mall in Washington DC in 1926! Since altitude, time of day, time of year, cloud cover, and distance from the equator all alter daylight color temperature, one value does not apply to every situation.) Don't be afraid to experiment a bit to find the white balance you like best. In general, I find that **Flash -2** *is the quickest way for me to set a sunny white balance I like, and I also tend to use much higher color temperature values than Nikon suggests for most indoor lighting (e.g.* **Incandescent -1** *or* **–2***).*

The D80 detects white balance in two different ways: (1) via the 420-pixel sensor in the viewfinder; and (2) via the main imaging sensor itself. Nikon doesn't reveal how these two systems interact, but it's clear to me that the D80 has less accurate automatic white balance than the D2xs, which has a dedicated white balance sensor.

Let's look at color temperature in action. Since color temperature for daylight was originally determined on the Washington Mall, let's go there for our test. Below you'll find a photo taken late in the day (in late April) of the Lincoln Memorial. I've tweaked this photo a bit to saturate the colors and tone down the sky (which also has a graduated neutral density filter holding it back), but if you were standing next to me at the time, this would be pretty close to what you saw:

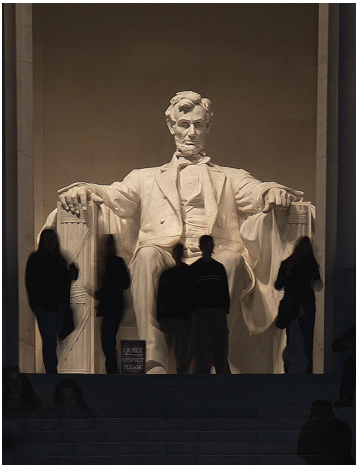
The left portion of the monument is the area we'll work with (though note the slight orange areas under the eaves in the front—we'll be coming back to those in a moment). Let's look at a number of options for white balance:

From left to right: 3400K, 3800K, 4400K, 4800K, and 5200K. I've added just a bit of color saturation to emphasize the cast. All photos taken at the same camera settings and processed through Nikon Capture NX the same.

You should notice in the above examples that as the color temperature on the camera is set lower than the actual value present in the lighting, a blue cast appears in the photo. (That again brings up Nikon's choice of 5200K for Daylight—most of the time you'll find that it generates results that are slightly on the blue side).

The further we get from the actual color temperature, the more distinct that cast is. Note, too, that the cast applies to everything: sky, building, and bushes. It isn't until you get 5200K that we begin to see some of the warmth that is in the limestone and sky, and it isn't until we get over 5500K that the greens actually become fully green (no hint of blueness; compare the larger photo with the rightmost small one and look at the greens).

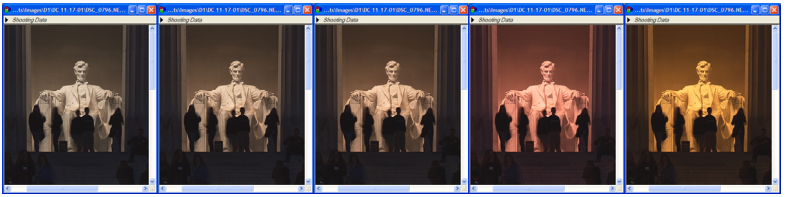
Remember those orange spots on the walls of the Memorial? Those are areas lit by incandescent light, which has a lower color temperature than daylight. Inside the Monument, Lincoln's bust is mostly lit by incandescent lighting. Here's another full photo to consider:



Lincoln Memorial at night, when only the internal overhead lighting contributes to color temperature.

Now we're dealing with mostly incandescent lighting, which has a lower color temperature (most bulbs used on large

buildings like this one are of the Photoflood variety, and about 3200K in output). There's a bit of overhead fluorescent in the Monument as well, but the incandescent pretty much overwhelms it where Lincoln sits.



From left to right: 3000K, 3200K, 3400K, 5000K, 6000K. All camera settings and Nikon Capture NX settings otherwise the same.

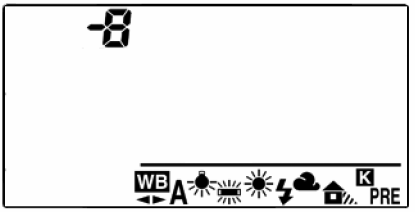
You should notice in the above examples that as the color temperature on the camera is set higher than the actual value of the lighting, a red/orange cast appears in the photo. The further we get from the actual color temperature, the more distinct that cast is.

So remember that orange cast on the outside of the building? That was caused by setting a color temperature higher than the actual color temperature. Most of the building was lit by the sun and sky, so the color temperature on those portions of the building was high (5500K to 6000K based upon my observation). The spots under the eaves that are orange were lit by incandescent light that was close to 3400K. Thus, if the rest of the building is rendered correctly, those spots turn orange.

This illustrates a common problem: in many scenes, there is no single color temperature of light that affects everything. An area in shade on an otherwise sunny day may be slightly higher color temperature than that in direct sun. Indoors you may find both incandescent and fluorescent bulbs lighting different areas. If the different lighting sources are equally mixed on your subject, you can use the Preset method of setting white balance and measure the value off a gray card (see below). But if the areas of different lighting are separate—incandescent lighting a foreground subject and fluorescent lighting a background, for example, you have to pick a color

temperature and live with the results, as I did in the photo outside the Lincoln Memorial[94].

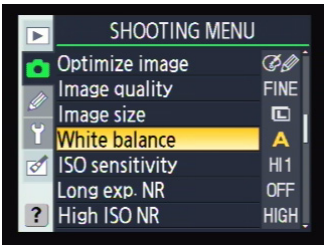
To set the white balance: press and hold the **WB** button while rotating the Rear Command Dial until the icon for the desired method is shown on the top LCD. The Front Command Dial can be used to control the fine tuning of white balance (setting –3 to +3 increments on the basic value—more on that in a bit).



Top LCD:
(Upper area indicates Fine Tuning value; lower icons indicate the white balance setting)

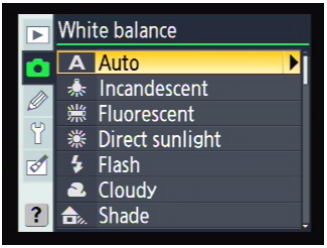
Alternatively:

1. Press the **MENU** key to show the menu system.
2. Use the Direction pad to navigate to the SHOOTING menu (camera icon tab).
3. Use the Direction pad to select the **White balance** option and press the ▸ key on the Direction pad or the **OK** button to see the submenu.

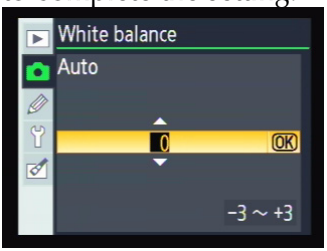


[94]Other solutions exist. You could filter one or other of the light sources, add light of a different color (e.g. flash) to overwhelm the poor color, turn the troublesome light off, and more.

4. Use the Direction pad to highlight the white balance option you want and press the ▸ key or the **OK** button to select it.



5. Use the ▴ and ▾ keys on the Direction pad to set any fine tuning you desire and the ▸ key or the **OK** button to complete the setting.



Nikon only provides a cryptic system for indicating the fine tuning changes (whole numbers from –3 to +3, where negative numbers set a *higher* color temperature while positive numbers make the color temperature *lower*—what was Nikon thinking?[95]). Here's how these numbers influence each of the white balance settings:

[95] I don't know. But here's what *you* should be thinking: higher values make for cooler-looking pictures; conversely lower values make for warmer photos.

D80 White Balance Settings

Approximate resulting color temperatures are:

	Approximate Kelvin value						
	-3	-2	-1	0	+1	+2	+3
Incandescent	3300	3200	3100	3000	2900	2800	2700
Fluorescent	7200*	6500*	5000*	4200*	3700*	3000*	2700*
Direct Sunlight	5600	5400	5300	5200	5000	4900	4800
Flash	6000	5800	5600	5400	5200	5000	4800
Cloudy	6600	6400	6200	6000	5800	5600	5400
Shade	9200	8800	8400	8000	7500	7100	6700

The asterisks in the above table indicate that these white balance values are not color pure—Nikon uses hue adjustments to shift the colors to better match the odd balances of fluorescent tubes. Because fluorescent lighting uses colored phosphors that don't produce the entire light spectrum, and because those phosphors decay at different rates, most digital cameras have fluorescent settings that attempt to deal with the overabundance of green/blue values such light produces. The D80 does this, too. If you use the fluorescent white balance settings on light that was produced by a continuous spectrum light source (most other lighting), you're likely to see a cyan and/or green shift.)

Put another way, here are the changes in color temperature from the middle setting:

	Change in Kelvin value						
	-3	-2	-1	0	+1	+2	+3
Incandescent	+300	+200	+100	0	-100	-200	-300
Fluorescent	+3000	+2300	+800	0	-500	-1200	-1500
Direct Sunlight	+400	+200	+100	0	-200	-300	-400
Flash	+600	+400	+200	0	-200	-400	-600
Cloudy	+600	+400	+200	0	-200	-400	-600
Shade	+1200	+800	+400	0	-500	-900	-1300

You can see that some of the white balance settings have fine tuning increments that are small, others span over a much wider range. Fortunately, Nikon also allows you to set a

specific Kelvin value in 10 MIRED[96] increments from 2500 to 9900K.

Let's put those D80 preset and settable Kelvin values in context of actual lighting sources (all values except the first can be set on the D80 in some way):

1930K	Candlelight (value can't be set on D80)
2500K	(lowest value that can be set on D80)
2550K	
2650K	
2700K	**INCANDESCENT +3**
2800K	**INCANDESCENT +2**, 75-watt bulb
2850K	
2900K	**INCANDESCENT +1**, 100-watt bulb
2950K	
3000K	**INCANDESCENT**, 200-watt bulb
3100K	**INCANDESCENT -1**
3200K	**INCANDESCENT –2**, Tungsten lighting
3300K	**INCANDESCENT -3**
3400K	Standard photolamp
3600K	
3700K*	**FLUORESCENT +1**
3800K	
4000K	
4200K*	**FLUORESCENT**
4300K	
4500K	
4800K	**DIRECT SUN +3**
4900K	**DIRECT SUN +2**
5000K	**DIRECT SUN +1**

[96]MIRED stands for MIcro REciprocity Degree, a form of defining color shifts in a manner where each shift in value equals an equivalent perceived difference. Kelvin doesn't work that way: small differences in Kelvin at low temperatures (e.g. 2800K) make for bigger perceived color shifts than small differences at high temperatures (e.g. 7000K). If you shift a color value by 1 MIRED, it shifts the same perceived amount, regardless of whether we're talking about red (low Kelvin values) or blue (high Kelvin values) lighting.

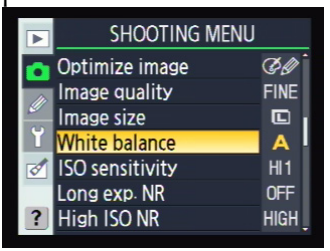
5200K	**DIRECT SUN**, Carbon arc lighting (movie sets)
5300K	**DIRECT SUN -1**
5400K	**DIRECT SUN – 2**, sunny daylight standard
5600K	**DIRECT SUN -3**
5800K	**FLASH –2**, Typical Nikon flash value
5900K	
6000K	**FLASH –3**, Brand new Nikon flash
6200K	**CLOUDY -1**
6300K	
6400K	**CLOUDY –2**, high elevation sunny
6500K*	**FLUORESCENT -2**
6600K	**CLOUDY -3**
6700K	**SHADE +3**
7100K	**SHADE +2**, Overcast sky
7200K*	**FLUORESCENT -3**
7500K	**SHADE +1**
7700K	
8000K	**SHADE**
8300K	
8400K	**SHADE -1**
8800K	**SHADE -2**
9100K	
9200K	**SHADE -3**, Shaded area in hazy sun
9900K	Highest value a D80 can set

Note: If you also use a D1H or D1X, most of the named values that were just shown are the same, though Nikon has made a few shifts in the **Incandescent** *values. The D2 series, D50, D70, D100, D200, and now D80 share the same Kelvin values.*

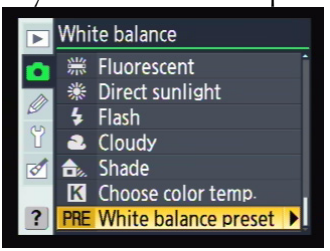
The D80 also allows you to measure the lighting in a particular location and manually select an appropriate white balance using the **PRE** selection. To select and set a white balance of **PRE**, there are additional steps you must take.

📷 To set white balance from a neutral reference source (if the white balance is already set to **PRE**, you can skip to Step 7):

1. If the camera is in Manual exposure mode, set a correct exposure for the gray or white card you'll use in Step 8, below, before proceeding.
2. Press the **MENU** button to show the menu system.
3. Use the Direction pad to navigate to the SHOOTING menu (the camera icon tab).
4. Use the Direction pad to navigate to the **White balance** option and press the ▸ key on the Direction pad or the **OK** button to select it.

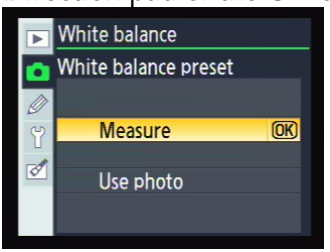


5. Navigate to **White balance preset** and press the ▸ key on the Direction pad or the **OK** button to select it.



Alternatively: Press and hold the **WB** button on the camera while turning the Rear Command dial until PrE is displayed on the top LCD.

6. Navigate to **Measure** and press the ▸ key on the Direction pad or the **OK** button to select it.



7. Press the **MENU** button to turn off the menu system.
8. Press and hold the **WB** button on the camera until PrE begins flashing on the top LCD and in the viewfinder.
9. If you wish to measure off a neutral gray or white card, frame it fully in the viewfinder and press the shutter release.
10. If an acceptable white balance value was measured, you'll see Good on the top LCD (Gd in the viewfinder). If the camera couldn't get a usable reading, you'll see no Gd in both the top LCD and the viewfinder. If you see no Gd, return to step 7 and try again.

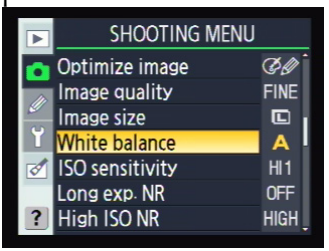
If you see no Gd instead, check your exposure and try again.

Note: *Practical field tests show that* **PRE** *works more consistently using a neutral gray card than it does with a white card (Nikon suggests either). A neutral gray card should, by definition, generate a correct exposure and has no color cast. A white card is often underexposed (as compared to the eventual scene, unless you use Manual exposure mode and exactly followed my instructions, above) and sometimes contains a colored pigment to make it appear "whiter." Suggestion: use white in a pinch, but bring a Kodak gray card with you whenever possible and use it for setting white balance.*

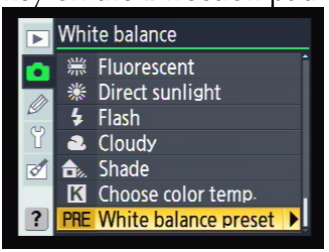
Tip: *You can use slightly colored cards to make the overall color balance warmer (redder) or cooler (bluer). Just pick a light version of the color you want to remove from the scene. For example, to make a warmer (redder) rendition, use* **PRE** *and measure on a light blue card. To remove green from fluorescent lights, try using a light green card. If you don't want to go to the trouble of making your own cards, do what the video pros do: buy a pre-made set from* http://www.warmcards.com.

To set a white balance from an existing photo:

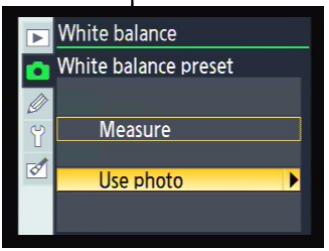
1. Press the **MENU** key to show the menu system.
2. Use the Direction pad to navigate to the SHOOTING menu (the green camera icon tab).
3. Use the Direction pad to navigate to the **White balance** option and press the ▸ key on the Direction pad or the **OK** button to select it.



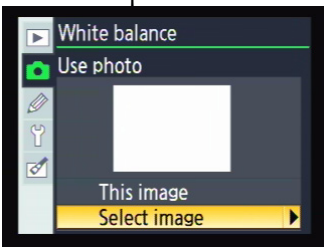
4. Navigate to **White balance preset** and press the ▸ key on the Direction pad or the **OK** button to select it.



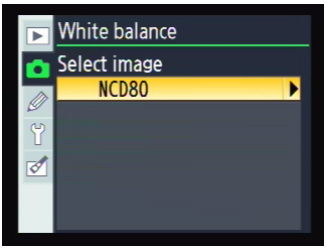
5. Navigate to **Use photo** and press the ▸ key on the Direction pad or the **OK** button to select it.



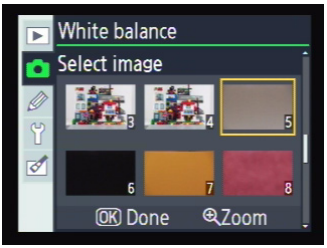
6. Navigate to **Select image** and press the ▸ key on the Direction pad or the **OK** button to select it.



7. Navigate to the folder that contains the image you wish to use and press the ▸ key on the Direction pad or the **OK** button to select it.



8. Navigate to the image you want to use and press the **OK** button to select it.



Note: *You can only copy white balance from an image taken with a D80. Curiously, the D80 will sometimes show you images from other cameras, but you'll get an error message (***Can only use photo taken with D80***) if you select one.*

You may wonder why you'd want to copy white balance from an existing picture on the card. Let me give you an example of when this is handy. Let's say you were assigned to shoot a wedding. During a relatively short period of time you need to take pictures in the wings of the church, at the altar during the ceremony, out on the steps of church, and in several different

rooms at the reception. Let's assume further that all these locations have tricky lighting conditions (any wedding photographer can tell you that they usually do). You're also going to be moving back and forth amongst those locations and don't want to chance missing a moment because you were trying to figure out white balance.

You can run around prior to the service and capture custom white balances for each of the locations, taking a picture with the correct white balance at each. Now, as you move from location to location during the wedding, you could quickly grab the white balance from an image you've already taken instead of having to go through the entire gray card reading method of setting white balance. Unfortunately, it doesn't really save an enormous number of steps on the D80, but it is convenient enough to be effective in actual practice (moreover, you don't have to keep getting your gray card out).

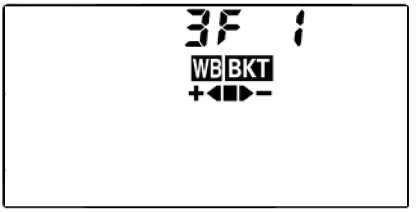
Once you've assigned a preset value, either via measurement or reference image, you can quickly recall it at any time by simply choosing a white balance of **PRE**.

Note: White Balance settings, including those for PrE, are maintained when the camera is turned off and turned back on.

You can also bracket the white balance settings on the D80:

1. Make sure that **Image Quality** isn't set to NEF (white balance bracketing only functions for JPEG images).
2. Set Custom Setting #13 to **WB bracketing**. (See "Exposure Bracketing Method" on page <415>).
3. Hold down the BKT button while rotating the Rear Command dial until BKT appears in the top LCD. When

this icon is displayed, exposure bracketing is active.

Top LCD: 

4. Tell the camera how many pictures by holding down the BKT button and rotating the Rear Command dial, and at what white balance intervals by holding down the BKT button and rotating the Front Command dial until the top LCD displays your selection (see "D80 White Balance Bracketing Values Table," below).

Turning white balance bracketing OFF is easy: simply repeat Step 3, above, but rotate the Rear Command dial until **WB BKT** no longer appears.

D80 White Balance Bracketing Values Table

Top LCD Display	*Total Shots*	*Exposures*
3F 1	3	set value, -1, +1 fine tuning
3F 2	3	set value, -2, +2 fine tuning
3F 3	3	set value, -3, +3 fine tuning
+ 2F 1	2	set value, +1 fine tuning
+ 2F 2	2	set value, +2 fine tuning
+ 2F 3	2	set value, +3 fine tuning
- 2F 1	2	set value, -1 fine tuning
- 2F 2	2	set value, -2 fine tuning
- 2F 3	2	set value, -3 fine tuning

One final word about white balance: if you shoot NEF files, you can select your white balance after the fact (and try out different white balances to see which you like). Both the Nikon Photoshop plug-in and Nikon Capture NX allow you to choose a white balance before the computer interpolates the final image data[97]. Be careful of images with blown channels,

[97]Actually, all raw converters do, though some may not access the encrypted white balance information stored by the camera (see "The NEF White Balance Controversy," on page <143>).

however. When you blow out a single channel and then later try to adjust white balance using a NEF converter, you may see slight, uncontrollable shifts in the color of highlight detail, especially if you use third party converters.

Changing Color Characteristics

Besides white balance, several other camera controls have an influence on the color, and to a lesser degree, exposure[98], in the image captured by the D80: **Optimize Image**, **Tone Compensation**, **Hue Adjustment**, **Saturation**, **Color Space**, **Color Mode**, and **Black-and-White**. I'll deal with Color Space later in the book (see "Color Profiles, Color Spaces, and Color Modes" on page <522>), but the other controls are, like white balance, controls that you tend to set often in the field, so we'll deal with them now.

The D80 tries to simplify the setting of these items (and a few others) by grouping them together under one-word shortcuts on the **Optimize Image**. You can set **Normal**, **Vivid**, **More Vivid**, **Softer**, **Portrait**, **Black-and-White**, and **Custom**. Only the last two options, **Black-and-White** and **Custom**, allow you to fine tune the individual color and contrast controls. If you set the camera to one of the other options, the camera makes those choices for you:

	Sharpening	Tone	Color Mode	Saturation
Normal	Auto	Auto	1a	Auto
Softer	Low	Low	1a	Auto
Portrait	Medium Low	Auto	1a	Auto
Vivid	Medium High	Normal	3a	Enhanced
More Vivid	High	High	3a	Enhanced

Note that a setting of **Auto** for any of these items has different "personalities" that the camera uses but you can't set directly.

[98]Technically, the exposure isn't changed, but when you begin adjusting colors and contrast, our perception of the exposure may change.

Note that the first three in the table differ only in the Sharpening setting, so they really aren't much more than a faster way to set lower sharpening values. Note that the last two settings bump up all the values, something that makes channel blowouts much more likely, and in high contrast scenes, reduces subtlety considerably.

Normal:

Softer:

Portrait:

Vivid:

More Vivid:

B&W:

For a totally novice D80 user, it's probably okay to select the **Optimize Image** shortcut for the type of picture you're taking. Still, I think that taking direct control over settings gives you more flexibility and slightly better results. Here's how *I'd* set those things manually as a starting place:

ala Thom	**Sharpening**	**Tone**	**Color Mode**	**Saturation**
Normal	Medium High	Normal	1a or 2*	Normal
Softer	Medium Low	Normal	1a or 2*	Normal
Portrait	Medium Low	Medium Low	1a	Normal
Vivid	Medium High	Normal	2*	Enhanced
More Vivid	Medium High	Normal	3a	Enhanced

Means* **AdobeRGB *is set as the Color Space*

You should notice that I avoid the **Auto** settings, and am somewhat less aggressive about swinging the controls to the extremes. I'm sure Nikon has made these preset variations differ as much as they do so that the changes would be obvious even on the camera's color LCD. Also notice that all the presets will produce sRGB Color Space files and override any AdobeRGB Color Space setting you've made.

Personally I avoid the **Auto** settings because you never can 100% predict what they'll give you. I avoid the extremes for the controls because it's always easier to add more in post processing than take out what you've added. That's especially true for **Tone Compensation** and **Saturation**. I also want the Color Space to be wider if I'm going to boost **Saturation** values, so Color Mode 3 with sRGB is suspect in my mind—you really want to be in AdobeRGB (Color Mode 2) if you're pushing colors up in saturation.

So let's explore the individual settings that you can manipulate in **Black-and-White** and **Custom** (at least the ones I don't deal with elsewhere):

Custom: Black and White

New to the D80 is the ability to refine how the black and white transforms work (previous Nikon bodies simply set the

RGB channels to the luminance value). The D80 allows you to mimic the use of color filters.

So before we get to the details of how you make the black and white settings, we need to discuss what filtration does.

With black and white film, a colored filter *allows* light of that color to appear in the resulting image but removes the opposing color on the color wheel. Many black and white photographers liked to increase the contrast between the sky and clouds, for example. Sky is blue (a single color) while clouds are white (all colors). By using a yellow filter (the opposite color of blue on the color wheel [see the wheel in the section on Hue that begins on page <300>]) they mostly remove blue, but allow the other colors to pass. This keeps the clouds white but makes the sky dark, increasing contrast.

Thus, you have to think a bit backwards when choosing filtration for black and white work. Allowing a color keeps it contributing to the exposure (i.e., brighter values of that color will progress towards white) but restrict its color wheel opposite from contributing to the exposure (i.e., keep the tonal values for it in the dark range of the exposure). The "strength" of the filter determines how dramatic the removal/acceptance effect is. Nikon has chosen modest filtration values for the D80; you'll definitely see visual changes, but they might not be as dramatic as you'd get with large amounts of filtration.

Here's what the filter choices do:

Yellow Applies imaging changes similar to what a yellow filter produced with B&W film: adds contrast, darkens sky.

Orange Applies imaging changes similar to what an orange filter produced with B&W film: adds more contrast than yellow filter, darkens sky more than yellow.

Red Applies imaging changes similar to what a red filter produced with B&W film: adds more contrast than orange filter, darkens sky more than orange.

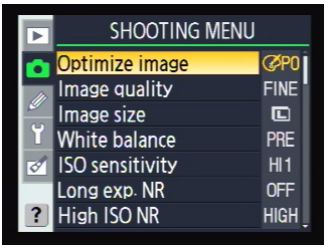
Green Applies imaging changes similar to what a green filter produced with B&W film: lowers contrast on skin tones.

Another way of looking at the filtration:

Filter	*Mostly Darkens*	*Slightly Darkens*
Yellow	Blue	Magenta, Cyan
Orange	Cyanish Blue	Blue, Cyan
Red	Cyan	Blue, Green
Green	Magenta	Blue, Red

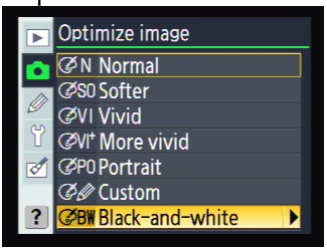
Here's how you set the black and white recording options on the D80:

1. Press the **MENU** key to show the menu system.
2. Use the Direction pad to navigate to the SHOOTING menu (the camera icon tab).
3. Use the Direction pad to navigate to **Optimize Image** and press the ▸ key on the Direction pad or press the **OK** button to select it.

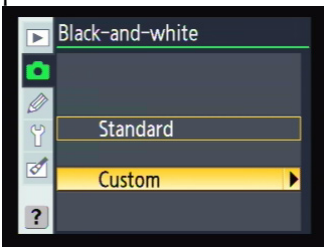


4. Use the Direction pad to navigate to the **Black-and-white** option and press the ▸ key on the Direction pad

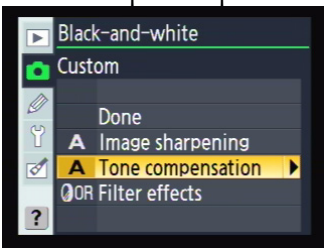
or press the **OK** button to select it.



5. Use the Direction pad to navigate to the **Custom** option and press the ▸ key on the Direction pad or press the **OK** button to select it.

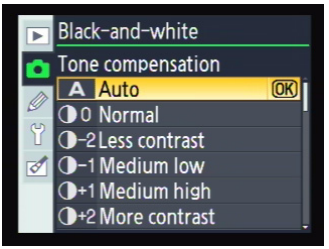


6. Use the Direction pad to navigate to the **Tone compensation** option and press the ▸ key on the Direction pad or press the **OK** button to select it.

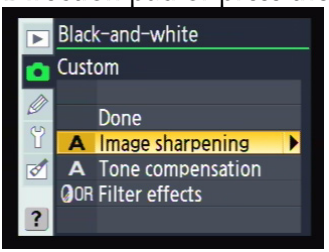


7. Use the Direction pad to navigate to your choice for the **Tone compensation** option and press the ▸ key on the Direction pad or press the **OK** button to select

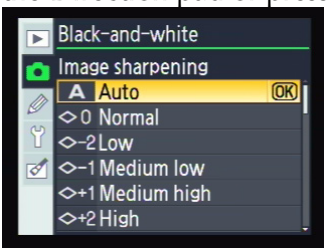
it.



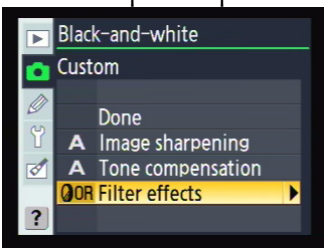
8. Use the Direction pad to navigate to your choice for **Image sharpening** option and press the ▸ key on the Direction pad or press the **OK** button to select it.



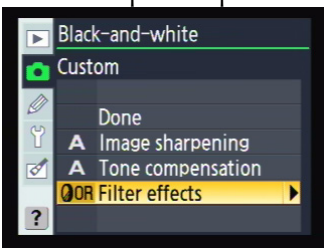
9. Use the Direction pad to navigate to your choice for the **Image sharpening** option and press the ▸ key on the Direction pad or press the **OK** button to select it.



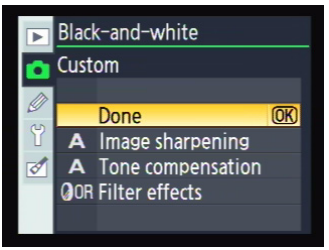
10. Use the Direction pad to navigate to your choice for **Filter effects** option and press the ▸ key on the Direction pad or press the **OK** button to select it.



11. Use the Direction pad to navigate to your choice for the **Filter effects** option and press the ▸ key on the Direction pad or press the **OK** button to select it.



12. Use the Direction pad to navigate to **Done** and press the ▸ key on the Direction pad or press the **OK** button to select it.

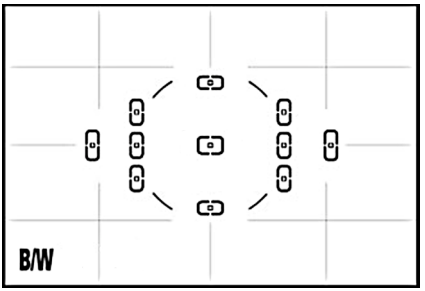


Alternatively, you could have simply chosen **Standard** at Step 5 and gotten a black and white setting with no filtration and the **Auto** settings for **Tone compensation** and **Image sharpening** (not recommended).

When any of the black-and-white options are chosen to be active, the camera displays an indicator in the top LCD and—if Custom Setting #9 isn't set to **Off**—in the viewfinder (via an overlay in the imaging area).

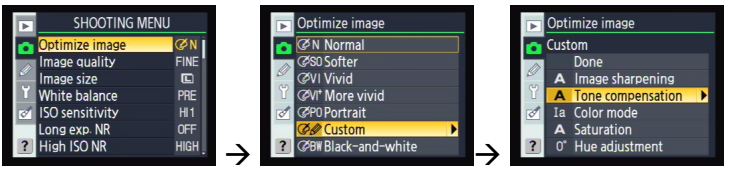
Top LCD:

Viewfinder:

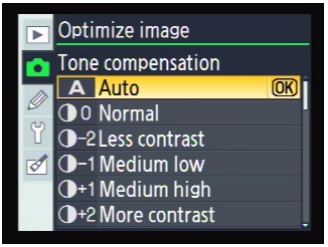


Custom: Tone Compensation

This control would be better labeled Contrast Adjustment, as that's what you'll see change as you make adjustments. With **Tone compensation**, you tell the camera what kind of exposure curve to apply to the sensor data. You may remember a footnote back in the sensor section where I pointed out that a digital sensor is more regular in capturing brightness values than film. The "normal" regularity is a curve that rapidly rises in the dark values but tapers a bit as it reaches the bright values[99]. **Tone compensation** changes the slopes of that curve, which shows up to our eyes as image contrast.



[99]Okay, that's a gross simplification. I wrote a long article in my *Nikon DSLR Report*, Issue #5 that describes in gory detail the "normal" way in which brightness values becomes bit values, if you're so inclined to get beyond the simplification.



Choosing **Less contrast** tends to "flatten" and "narrow" the curve (and narrow the resulting histogram), resulting in considerably less overall scene contrast, often at the expense of rich blacks. Choosing **More contrast** tends to exaggerate the curve (and widen the resulting histogram), producing distinct blacks and whites (which may be blown out) with less subtle gradation in between. **Normal** is obviously between these two extremes. The **Auto** setting uses the camera's matrix meter to take a guess at how to set contrast. If it sees large differences in brightness values, the camera may think it's dealing with a high contrast scene and *lower* the contrast (think about that statement; it's correct). Likewise, it might do the opposite if there are few or small differences in brightness values across the scene.

The final option, **Custom**, is only useful if you have Nikon Camera Control Pro and enough time on your hands to come up with a contrast adjustment curve of your own (see "Custom Curves" on page <519>). For NEF images that you're going to run through Capture NX, the **Tone compensation** value is not particularly important (though be careful of the extreme settings, as it impacts the histogram calculations).

For JPEG images, you absolutely need to set something, with **Auto** being the usual choice (the default). I believe that to be a poor choice, as it tends to make adjustments on some images that reveal more noise. I have a tendency to set **Less contrast** (it's always easier to add contrast than it is to remove it) or **Normal**, both of which don't exhibit the problem of pulling up noise on some images. I'll also talk

about the **Custom** setting later in the book (see "Custom Curves" on page <519>).

Normal contrast. Watch the light/dark color patches on the Kodak test chart: as contrast goes down, the difference between upper and lower values lessen; as contrast goes up, these differences increase.

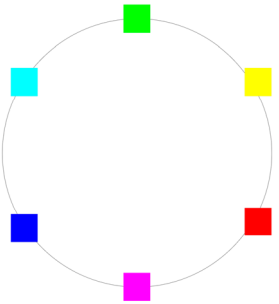
Less contrast. It's a subtle thing, but note how the bright orange, red, and yellow colors have changed, and the black-on-white resolution chart seems a little dark gray on light gray.

More contrast. Just the opposite: reds and oranges go out of gamut, the deeper purples and greens darkened, and the resolution chart has more contrast.

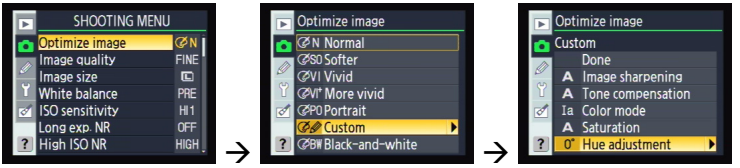
Custom: Hue

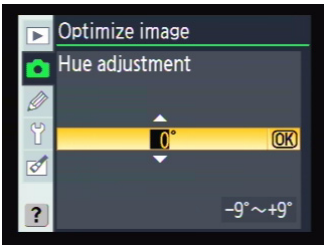
This control adjusts the relative intensity of the red, green, and blue values recorded for pixels. You can use this control to select increments of ±3° in color change, up to a total of ±9°. Graphic artists will recognize this as being a deviation value

on a standard color wheel (R, G, and B being 120° apart in the wheel). Just as a reminder, the basic orientation of the color wheel looks like this:



Red, green, and blue are each 120º away from each other, as are cyan, yellow, and magenta. Normally you'll see color wheels drawn as continuous variations (there's a range of oranges between yellow and red, for example), but I'm showing it this way for a reason I'll get to in a minute. Grand total, we can move the hue 18º around the circle using the controls on the D80; that's about one-third of the way between any of the two colors I show in the wheel, above.





Note: If you also use a D1, you need to be aware that Nikon changed their naming scheme for hue between the original D1 models and the D80. On the D1[100], you set values between 0 and 6, where 3 was the middle position and neutral. On the D80 you set values between -9° and +9°, with 0 being the neutral position. A value of 0 on a D1 corresponds to -9° on a D80; a value of 6 on a D1 corresponds to +9° on a D80. While the change is somewhat confusing, this new scheme has a real-world component (i.e. it isn't just a set of random numbers made up by Nikon, as was the case for the original D1).

Hue +9. *Look closely at the reds (flower, upper right; wrapping on flower pot mid-right). They're redder. Also note the yellows have a bit of green to them.*

Hue -9. *Now the reds are headed magenta while the yellows are trending orange (note also the orange fish going nuclear, or out of gamut).*

Here's the misnomer about **Hue** and the reason why I showed the color wheel the way I did: minus values don't "warm" while plus values "cool." Some colors may get "warmer" or "cooler," but the color spectrum is a continuous circle, so every color is affected in slightly different ways:

Hue Minus *Hue Plus*

[100]The D1X firmware was updated when the expanded buffer was introduced, and the newer hue control scheme also applies to D1x models with updated firmware.

	Values	*Values*
Red	Adds magenta	Adds yellow
Magenta	Adds blue	Adds red
Blue	Adds cyan	Adds magenta
Cyan	Adds green	Adds blue
Green	Adds yellow	Adds cyan
Yellow	Adds red	Adds green

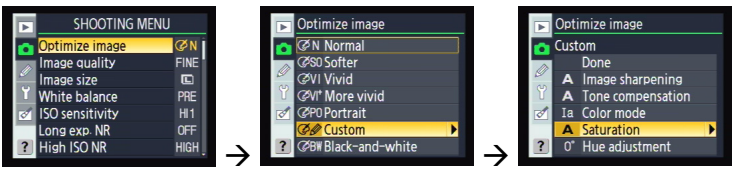
Thus, a skin tone, which has reds and yellows in it, gets both a red and a magenta boost with a minus **Hue** value, which may not be what you want. On the other hand, a plus **Hue** value might take the skin yellowier and greener. Which is the better choice? Well, it depends upon whether reds (plus) or yellows (minus) dominate the skin tone. And, of course, all the other colors are shifting, as well. In short, be very careful with hue adjustments.

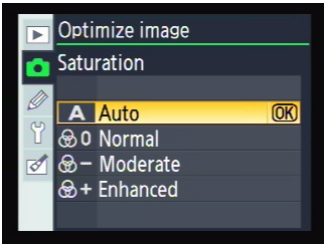
Custom: Saturation

The D80 allows you to control the saturation of a color.

Saturation is easy to understand if you think about it in terms of CIE Lab Color definitions, where luminance (brightness) is separated from chroma (color) information. If you boost saturation, you don't change the brightness of a pixel, you increase the amount of color in that pixel.

On the D80 there are four choices for Saturation:





Normal

Moderate: This setting lowers the overall color impacts. Note especially how the lighter color tones are getting very pastel in nature.

Enhanced: Cartoonish color, with some borderline colors going out of gamut they've been boosted so much. Because of that, it's a dangerous setting with a small Color Space such as **sRGB**.

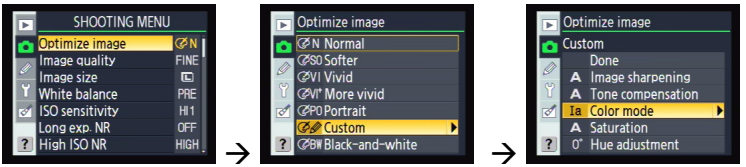
Custom: Color Space and Color Mode

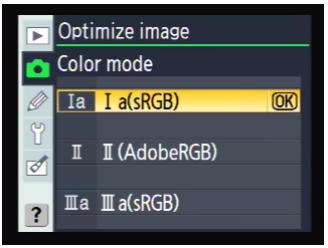
With the D80, Nikon repeats something that leaves some DSLR users confused: they combine Color Space and Color

Mode. Most previous editions of Nikon DSLRs combined these two settings into one, and limited your choices.

A "Color Space" is a definition of the gamut (size and extent) of colors that can be captured. A "Color Mode" refers to how accurate the colors are. See "Color Profiles, Color Spaces, and Color Modes" on page <522> for more information.

On the D80 there are three choices that set the Color Space and Color Mode together.





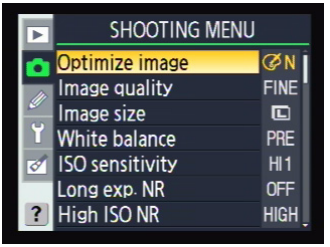
Color Mode Ia: Nikon doesn't say much other than "use for portraits." It's close to accurate, with a slight yellow (warming) addition to the red side of the color wheel.

Color Mode IIIa: Note the zonked orange, and to a lesser degree, the shifts in green intensity. Yellows are looking a bit green.

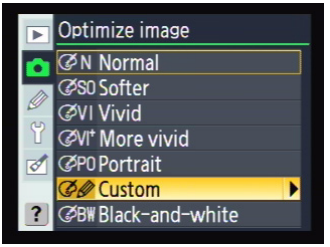
Custom: Setting Tone, Hue, Saturation, and Color Mode

To set any of these image optimizations:

1. Press the **MENU** key to show the menu system.
2. Use the Direction pad to navigate to the SHOOTING menu (the camera icon tab).
3. Use the Direction pad to navigate to **Optimize image** and press the ▸ key on the Direction pad or the **OK** button to select it.



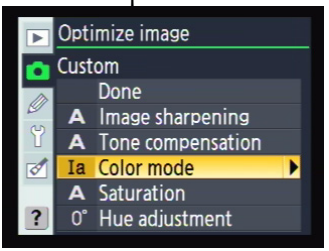
4. Use the Direction pad to navigate to the **Custom** option and press the ▸ key on the Direction pad or the **OK** button to select it.



Note that once you enter a **Custom** *(or* **Black-and-**

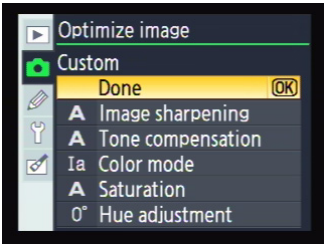
white) *setting for one option, you're responsible for setting all the other options, as well. The first five Menu Items in the* **Optimize image** *sub-menu set* all *options; once you begin using* **Custom** *(or* **Black-and-white**) you *must perform all the Menu Item settings.*

5. Use the Direction pad to navigate to the **Tone Compensation**, **Hue Adjustment**, **Saturation** or **Color Mode** option and press the ▸ key on the Direction pad or the **OK** button to select it.



6. Use the Direction pad to navigate to your choice (or to increment or decrement the hue value) and press ▸ key on the Direction pad or the **OK** button to select it.

7. *Important:* Use the Direction pad to navigate to the **Done** option and press the ▸ key on the Direction pad or the **OK** button to select it.



Lenses and Focusing

The D80 features the traditional Nikon F mount, and thus can use most lenses made for Nikon 35mm film cameras (see "Lens Compatibility" on page <316> for exceptions).

The white marker on the lens (right facing arrow in the photo) needs to be aligned with the white dot on the camera body (left facing arrow in illustration). Make sure the lens is perpendicular to the body, not at an angle.

One of the first things you need to do is mount a lens on your D80:

1. Turn the D80's power switch to the **OFF** position.
2. Twist the included BF-1A body cap 45 degrees clockwise, and remove it from the camera.
3. Align the mounting mark on the lens [101] with the mounting mark on the D80 (see figure, above) and then twist the lens counter-clockwise (when facing the front of the body) until it locks in place.

Tip: *The lens contacts and other aspects of the Nikon mount are actually quite impervious to damage caused by negligent lens mounting, but the Aperture Activation arm in the camera (black lever inside the left side of the mount as you look from the front) is. Make sure the lens is fully square to the mount and in the right position before twisting into the locked position. Damaging the Aperture Activation arm is usually done by trying to get the lens into the mount too fast and bumping the back of the lens against the arm.*

[101] The "mounting mark" is usually the focus mark on the lens (or the aperture indicator dot on the aperture ring, if the lens has one). However, most recent Nikkor lenses have another handy shortcut: on the lens mount one of the screws is painted black (since you're usually holding the lens so you see the mount, this is useful information). Use the black screw as your alignment point!

4. If you're using an autofocus lens, set the aperture ring (if it has one) on the lens to the smallest aperture (usually f/22, but sometimes f/16 or f/32 or even f/45 on Nikkor lenses) and lock it at that aperture. *Failure to set the aperture ring to the smallest aperture will result in* **FEE** *being shown on the top LCD (see "Error Messages" on page <367>).*

   If you're using an AI or AI-S lens, you should note that metering will *not* be available (it *is* available on the D200 and D2 series cameras).

Changing lenses follows the same steps, except that you're removing the mounted lens in Step 2 instead of a body cap (and you have to hold down the lens release button during that step).

Note: When no lens is mounted, you should ***always*** *protect the sensor from dust by using the BF-1A body cap (see "Keeping the Sensor Clean" on page <538>).*

Note: The body cap for the D80 (BF-1A) is different than the one for earlier, manual focus 35mm film cameras (BF-1) and much different than the cheap plastic cap that comes with the N80 and some other Nikon bodies. Nikon states that the older BF-1 body caps should not be used on the D80. The older body caps (and some generic, third party body caps) don't accommodate the electrical contacts built into the autofocus lens mounts.

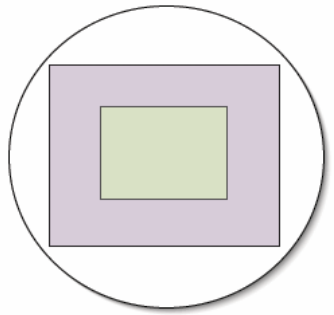
Focal Length Limitations

Because Nikon chose to retain its F mount on the D80, virtually every lens Nikon has made in the past 30 years can be mounted on a D80. But the field of view you see in the viewfinder is different on a D80 than on a 35mm film body.

The D80 crops the field of view by about 1.5x. This means that a 14mm lens mounted on a D80 has about the equivalent field of view of a 21mm lens mounted on a 35mm film Nikon body (see the table later in this section).

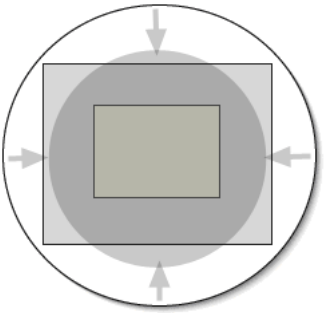
Field of view changes when a Nikon lens is mounted on a D80 because the camera's sensor is physically smaller than the 35mm frame for which it was originally intended. Note that I keep using the term "field of view." The focal length of a lens is absolutely unchanged when you mount a lens on a D80. Indeed, the resulting image on a D80 is no different than if you took a picture with a 35mm body and then cropped it down to the smaller sensor area of the D80[102].

Note: I've read reports from professionals and editors who should know better that go something like this: "The D80's 1.5x magnification is like getting a 1.4x extender for free, with no aperture penalty." Sorry, but that's not really true. If you mount a 400mm f/2.8 lens on your 35mm body and then crop the resulting image to a ~28mm diagonal section in the middle, you'd get exactly the same image as you get from the D80.



The outer circle is the normal image circle of a 35mm lens. The purple frame is the boundaries of 35mm, the light green is the boundaries of the D80's sensor. The D80 is seeing only a portion of the area the lens covers. With lenses labeled as DX, the image circle is smaller (note the inner circle no longer covers the 35mm frame):

[102] In an earlier edition of one of my eBooks, someone challenged that assertion in regards to depth of field. But if you use the Zeiss method of depth of field calculations, as most people do, you'd have to change your Circle of Confusion value for the cropped 35mm image to match that of the APS-sized digital sensor. Thus, printed at the same size, they would look the same.



It *is* important to understand that, because of the small sensor size, the D80 only uses the innermost portion of the image resolved by most lenses. When you read lens tests in magazines or on the Internet, some criticisms of lenses may not apply when that lens is used on a D80[103].

For example, most wide angle lenses have light falloff in the corners when used wide open (at their widest aperture). Because the D80's sensor never sees those corners, light falloff may not be an issue for such lenses mounted on a D80. A good case in point is the Nikkor 18-35mm f/3.5-4.5D ED lens. On a 35mm body with the lens zoomed to 18mm and the aperture set to f/3.5, very visible falloff can be seen in the corners of the image, perhaps more than a half stop at the extremes. When that same lens is mounted on a D80, the falloff mostly disappears because the D80 doesn't see that image area! Still, there's perhaps a fifth of a stop falloff at the settings just cited—lower than you'd see on a 35mm body, but still present.

The 18-135mm f/3.5-5.6G DX lens included with the D80 "kit" uses a smaller image circle than earlier 35mm lenses (it barely covers the smaller digital sensor size), so at 18mm and the aperture set to f/3.5, it *does* show visible falloff when you use it on the D80. Ditto for the 18-200mm f/3.5-5.6G DX lens introduced with the D200.

[103]Chromatic aberration and light falloff, for example, increase with distance from the center, and the D80 doesn't use the far edges of the image circle of regular 35mm lenses. However, note that DX lenses have an image circle smaller than the 35mm frame and may exhibit edge characteristics.

The 12-24mm f/4G DX and 17-55mm f/2.8G DX are somewhere between a 35mm lens and the 18-135mm and 18-200 DX lenses: they have an image circle that covers the 35mm frame at some (but not all) focal lengths. In general, these latter two lenses show slightly fewer edge problems on a D80 than the 17-35mm f/2.8D shows on a full frame 35mm body.

Likewise, uncorrected chromatic aberration or lack of flat field focus capability may cause a lens to slightly soften the corners of images when mounted on a 35mm camera. But these issues are likely not as visible when using the D80. To my eye, there is no discernable difference in optical quality between the expensive Nikkor 17-35mm f/2.8D AF-S and the inexpensive Nikkor 18-35mm f/3.5-4.5D, at least when mounted on a D80. But there is when used on a 35mm body (though mostly in the corners).

Note: If you use your lenses on both a 35mm body and the D80, you still must pay close attention to corner issues. While the Nikkor 18-35mm f/3.5-4.5D ED is all a D80 user needs in the way of quality, I find the Nikkor 17-35mm f/2.8D AF-S far better when used on my F5. When I shoot 35mm film—especially with wide angle lenses—I usually choose the more expensive lens.

Overall, here are the key differences between using a lens on a 35mm film body and the D80:

Lens Differences When Used for 35mm film and D80

Item	*35mm film*	*D80*
Light Falloff	Significant in corners	Generally insignificant
Sharpness in corners	Often slightly soft	Sharp as central area
Colors in corners	Often slightly muted, chromatic aberration	Edge matches center, little if any chromatic aberration
Angle of view	As published	Altered (see chart, below)
Linear distortion*	Sometimes significant	Reduced
Vignetting w/ Filters	Sometimes significant	Reduced

**E.g. barrel distortion (typical of wide angle lenses) or pincushion distortion (typical of telephoto lenses)*

Items such as overall contrast, susceptibility to flare, center sharpness, and overall coloration are virtually identical for both 35mm and D80 use of a lens.

The following table illustrates the angle of view difference for each of the common Nikon focal lengths.

Note: The Lens Angle of View table (below) is slightly different than the one in Nikon's manuals, as it is derived from precise calculations involving image size and not the generic and rounded 1.5x factor Nikon uses (it should be 1.52). The D80's aspect ratio is close to that for 35mm in final pixel size (1.49:1 versus 1.5:1), but the exact "angle of view" depends upon whether you use the horizontal or diagonal axis figures.

Lens Angle of View

35mm focal length	*35mm Horz Angle*	*35mm Vert Angle*	*35mm Diag Angle*	*D80 Horz Angle*	*D80 Vert Angle*	*D80 Diag Angle*	*D80 equiv focal length*
14mm	104	81	114	80	59	91	21mm
15mm	100	77	110	76	56	87	23mm
17mm	93	70	103	70	50	80	26mm
18mm	90	67	100	66	47	77	27mm
20mm	84	62	94	61	43	71	30mm
24mm	74	53	84	52	36	61	36mm
28mm	65	46	75	46	31	54	43mm
35mm	54	38	63	37	25	44	53mm
50mm	40	27	47	27	18	32	76mm
60mm	33	23	40	22	15	27	91mm
70mm	29	19	34	19	13	23	106mm
85mm	24	16	29	16	11	19	129mm
105mm	19	13	23	13	9	15	160mm
135mm	15	10	18	10	7	12	205mm
180mm	11	8	14	7.5	5	9	274mm
200mm	10	7	12	6.75	4.52	8.12	304mm
300mm	6.86	4.58	8.24	4.5	3.01	5.42	456mm
400mm	5.15	3.43	6.19	3.37	2.26	4.06	608mm
500mm	4.12	2.74	4.95	2.7	1.81	3.25	760mm
600mm	3.43	2.29	4.12	2.25	1.5	2.71	912mm
800mm	2.57	1.71	3.09	1.69	1.13	2.03	1218mm

All angles of view are expressed in degrees. Values for lenses shorter than 300 have mostly been rounded to the nearest digit. Focal length equivalents have been rounded to the nearest digit.

The Nikkor 10.5mm f/2.8G DX is a fullframe fisheye. Its equivalent angles of view are approximately: 136 degrees wide, 88 degrees high, and 170 degrees diagonal.

35mm Frame Size: width = 24mm, length = 36mm, diagonal = 43.2666mm

D80 Frame Size: width = 15.8mm, length = 23.6mm, diagonal = 28.40mm

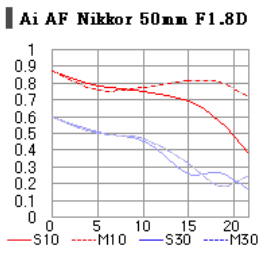
This "field of view magnification" poses both positive and negative issues for the D80 user:

- *Lack of Wide Angle Ability*—physical constraints make it difficult to build 35mm film lenses wider than 14mm without introducing significant barrel distortion and other

problems. Indeed, to do so even at 14mm is difficult, and involves costly aspherical lens elements to correct chromatic aberration (where colors focus at different points, a problem especially evident in corners of uncorrected wide angle lenses). Thus, using a lens originally intended for 35mm on a D80 limits you to an angle of view of only about 80° across the frame, while 35mm film users can easily obtain lenses that go as wide as 104°.

Fortunately, Nikon started building DX lenses, restoring our wide angle abilities (at the cost of buying new lenses).

- *Longer reach*—Wildlife photographers in particular are well known for sticking one or more teleconverters on already long lenses to "pull in" the animal (I've watched several mount both a 1.4x and 2.0x converter on a 500mm lens, resulting in an unwieldy and slow [f/11] 1400mm lens). Using a teleconverter not only makes the effective aperture of a lens one or two stops smaller than normal, but it also tends to decrease overall image contrast and quality, especially in the corners. While the smaller imaging area isn't the same as having a teleconverter, from a functional standpoint it's a built-in crop that many 35mm photographers had to do any way.



Let's look at one of Nikon's published MTF [104] tables to see why the 1.5x change of view is important. First things first: the vertical axis is an indication of contrast on a high frequency test chart (red being a frequency of 10 lines per millimeter and blue being 30 lines per mm). The solid and dotted lines indicate differences in the orientation of the line pairs being measured (sagittal and meridional orientations, thus the S and M in the legend). The higher a point is on the vertical axis, the better the "resolving power."

[104] *Modulation Transfer Function*. That's the name for a fancy test that measures the ability to resolve small alternations of black and white high-contrast lines (i.e. a test chart).

	The horizontal axis of the chart shows the distance from the center of the image area in millimeters. The charts show the full distance to the edges of a 35mm film camera—for the D80 we need only go to about 12 or 13 on the horizontal axis, as the smaller sensor means we don't get as far from the center. *Note that the lens being tested holds 30 lpm MTF values to about 0.5 up through 10mm from center. A value of 0.5 would be considered "acceptable." But look what happens on the full 35mm frame at 20mm from the center (the 35mm frame edge): we're at 0.2, which would be considered a poor showing. In other words, the corners of the image using this lens on a D80 would look better than the corners using this lens on a film body.*

Lens Compatibility

All D-type and G-type, AF-I, and AF-S lenses are fully compatible with the D80 and have unlimited use of any of the camera's features.

Other lens types, and a few specific lenses, either limit the features that can be used on the camera or should not be used at all:

Non-D and Non-G type AF lenses

- 3D matrix metering is not performed (i.e. distance information isn't used in the meter's decision).

AI-P lenses

- Autofocus is unavailable and the focus confirmation in the viewfinder only works with lenses with maximum apertures of f/5.6 or larger.
- 3D matrix metering is not performed (i.e. distance information isn't used in the meter's decision).

AI and AI-S Nikkors, lenses converted to AI

- Autofocus is unavailable and the focus confirmation in the viewfinder only works with lenses with maximum apertures of f/5.6 or larger.
- Metering system is inactive.
- Some reflex (mirror) telephoto lenses may not show focus confirmation in the viewfinder; apertures must be set on the lens.

	Auto-focus	*Unavailable Exposure Modes*	*Metering Limitations*	*Other Limitations*
D-type	Yes	None	None	None
G-type	Yes	None	None	Apertures can't be set on lens
Autofocus Non-D, Non-G	Yes	None	Matrix metering isn't 3D	None
AI-P	No	None	Matrix metering isn't 3D	None
AI and AI-S, older lens converted to AI	No	P, A, and S	No metering	Some slow lenses may not show focus confirmation.
AI lens converted to CPU*	No	None	Matrix metering isn't 3D	Flash focal length may be off.
Special case: PC Micro Nikkor 85mm f/2.8D	No	P, A, and S	Metering may be incorrect if lens is shifted or not at f/2.8	None

**See "Questions and Answers" on page < 709>*

In addition, several broad caveats apply when using certain types of lenses or accessories:

- *PC Nikkor*—exposure reading must be taken and set (locked) with the lens in a non-shifted position.

- *Teleconverters*—the effective aperture must be f/5.6 or faster for autofocus and viewfinder focus confirmation to work. AF-I type converters otherwise have the same compatibility as AF-I type lenses (i.e. full), while older AI type converters have the same compatibility as AI type lenses (i.e. limited).
- *Bellows and extension tubes*—have the same compatibility as AI type lenses, and the effective aperture must be f/5.6 or faster for viewfinder focus confirmation to work.

Finally, some individual lenses have additional limitations:

- *TC-16S AF Teleconverter* is incompatible and shouldn't be used.
- *Non-AI lenses are incompatible*, may cause damage to the camera, and shouldn't be used (note that most non-AI lenses can be converted to AI).
- *Lenses that require the AU-1 focusing unit* (e.g. the Nikkor 400mm f/4.5, Nikkor 600mm f/5.6, Nikkor 800mm f/8, and the Nikkor 1200mm f/11) are incompatible and shouldn't be used.
- *Fisheye lenses whose rear element sticks into the mirror box and that require mirror lockup* (e.g. the Nikkor 6mm f/5.6, Nikkor 8mm f/8, and Nikkor 10mm f/5.6 OP) are incompatible and shouldn't be used.
- *Nikkor 21mm f/4* lenses are incompatible and shouldn't be used. (Nikon's note in the manual implies that a later version of this lens might be compatible, but this lens has a rear element that sticks into the mirror box.)
- The K2 rings are incompatible and shouldn't be used.
- *Nikkor ED 180–600mm f/8* with serial numbers 174041 to 174180 are incompatible and shouldn't be used.
- *Nikkor ED 360–1200mm f/8* with serial numbers 174031 to 174127 are incompatible and shouldn't be used.
- *Nikkor 200–600mm f/9.5* with serial numbers 280001 to 300490 are incompatible and shouldn't be used.

- *Lenses for the F3AF* (e.g. the Nikkor 80mm f/2.8, Nikkor 200mm f/3.5, and TC-16 Teleconverter) are incompatible and shouldn't be used.
- *PC Nikkor 28mm f/4* with serial numbers of 180900 or earlier are incompatible and shouldn't be used.
- *PC Nikkor 35mm film f/2.8* with serial numbers 851001 to 906200 are incompatible and shouldn't be used.
- *PC Nikkor 35mm film f/3.5* is incompatible and shouldn't be used. (Note: Nikon's manual implies that a newer version of this lens can be used, but Nikon only made one version of this lens! Perhaps they were referring to the later f/2.8 version.)
- *Old style Nikkor 1000mm f/6.3* Reflex is incompatible and shouldn't be used. (This apparently refers to the version that was intended for rangefinder cameras, which have a different lens mount.)
- *Nikkor 1000mm f/11 Reflex* with serial numbers 142361 to 143000 is incompatible and shouldn't be used.
- *Nikkor 2000mm f/11 Reflex* with serial numbers 200111 to 200310 is incompatible and shouldn't be used.

Finally, note that if you use the MB-D80, you may need to use a short extension tube to use bellows or other accessories that stick far down below where lenses normally do.

The Autofocus System

The D80 uses a unique (as of this writing) autofocus system. While arguably state-of-the-art, Nikon's documentation of the autofocus system is not up to the same standard.

Autofocus is achieved using seven small contrast sensors, which are segmented into eleven actual autofocus sensing areas (the approximate locations and sizes are marked by brackets in the viewfinder).

How the autofocus sensors work is a bit difficult to describe, as both the physical implementation and the theoretical methodology used get a little intricate (though not as complex

as the D80's bigger brother that uses the same system, the D200).

The simple explanation of how the autofocus system works is that light goes through a partially silvered portion of the main mirror to a secondary mirror, which redirects the remaining light towards the bottom of the mirror box where the autofocus sensors live.

This remaining light next goes through what is known as a "separator" lens just above the autofocus sensors. This splits the light into two distinct "images" and the line sensor underneath measures the distance between them. Called *phase detection*, if the focus is in front of your subject, the image lines will be closer together than expected; while if the focus is behind the subject, the lines will be further apart than expected.

The camera's electronics look at the two image locations reported by the autofocus sensor being used and instructs the lens to move depending upon whether the lines are too close together or too far apart. In AF-S lenses, there is a motor in the lens that does the focusing; in all other Nikkor autofocus lenses the camera drives the focusing cam of the lens with a small screwdriver-like extension that sticks out of the lens mount (and is slower and less predictable in terms of speed due to different inertial loads in the lens).

A phase detection autofocus system has the benefit of being fast and direct. Once a calculation of how much "off" the two split images is made, the camera has precise knowledge of how far to instruct the lens to move and in which direction. That's why, when there's enough underlying contrast in the subject to produce data that can be interpreted, the Nikon autofocus system never "hunts" for the actual focus point.

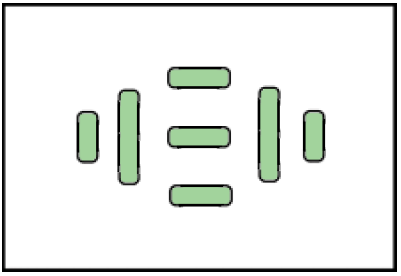
The drawback of all autofocus systems is that they have some level of focus tolerance. With subjects at midrange distances with decent contrast, focus tolerance errors tend to be insignificant—the difference between focusing at 12.10 and

12.12 feet is almost never perceptible in an image, even with moderate telephoto lenses.

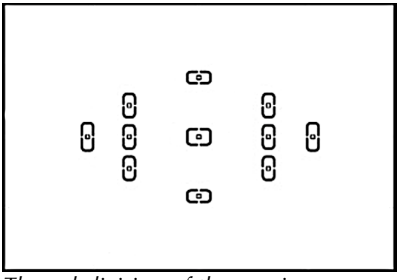
Where the focus tolerance can become a factor is with very long telephoto lenses or with very close subjects (macro and near macro ranges), especially when using maximum apertures. Even small misses in focus precision can result in slightly unsharp images at the extremes. But all the really long Nikkor lenses have focus override ability, and most macro shooters use focusing rails and manual focus for their work, so this doesn't become a big issue.

The Nintendo-like Direction pad on the back of the D80 is used to select the individual autofocus sensors and to navigate the camera's menus. If the Direction pad doesn't seem to be functioning correctly, move the lever just below the pad (see green arrow) to make sure that it isn't in the ***L*** *(lock) position. In the illustration, it's in the unlocked position (•).*

The autofocus sensor used in the D80 is called the CAM-1000; the D200 was the first camera to use that sensor, and the D80 is the second (and probably not the last). Previous Nikon cameras used either the CAM-900 (N65, N75, N80, D50, D70, and D100), CAM-1300 (F100, F5, and D1 series), or CAM-2000 (D2 series). The numbers in the part names indicate the overall AF sensing area, by the way, so all else equal, a CAM-1000 is better than a CAM-900, because it has ~10% more sensing area.



The actual sensing mechanism



The subdivision of the sensing mechanism as it is shown in the D80 viewfinder; note that middle three physical AF sensors are actually wider than what shows in the viewfinder.

Time for some controversy. The D80 actually has only seven autofocus "sensors" in it, arrayed as in the illustration at left.

The problem is that some of these sensors are quite long, meaning that they would be able to see something that you might not want seen as the subject. Nikon has thus subdivided the sensors, which splits two of them into three distinct areas, for a total of 11 different sensing areas.

Many of the "doesn't focus well" comments from D80 users comes from a misunderstanding of the location and size of these sensors, so study them well. Here's the second key to AF treasure: it's not enough that an object you want to focus on "touches" an AF sensor, it should probably cover at least half the active sensing area to provide reliable focus. This gets tricky with most of the sensors, as they are larger in size than the viewfinder indicates.

Finally, note that only one sensor, the central one, has sensitivity to detail in both the horizontal and vertical axis.

Obviously, we've got a lot to understand; the D80's autofocus system is quite complex.

Focus Type: Autofocus and Manual Focus

You set the type of focusing you want the camera to use by moving the Focus Mode lever on the front of the camera to:

AF *Autofocus*—when you press or partially press the shutter release the camera will attempt to focus the lens (assuming it's an autofocus lens, of course).

M *Manual focus*—the camera never attempts to focus the lens, even for autofocus lenses. You must use the focus ring on the lens to focus.

One confusing aspect is that many lenses also have a switch for these settings (labeled, even more confusingly: **A** and **M**, or **M/A** [105] and **M**). Here's what the switch looks like on the 18-135mm kit lens:

If ***either*** the camera or lens is set to **M**, you'll be manual focusing. The good news is that the viewfinder always indicates the focus status—even in manual focus mode—when you press the shutter release (or hold it halfway down):

[105] This dual notation—M/A—is to remind you that with this type of lens (AF-S) you can manually override the focus at any time (with other lenses it's an either/or situation).

- The subject is in focus

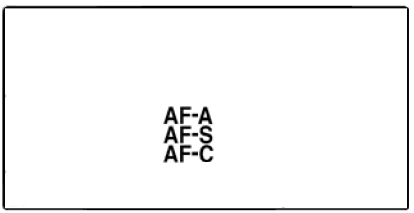
If this indicator does not appear, the subject under the selected autofocus sensor is not in focus. If this indicator is blinking, the camera cannot lock onto focus of the subject under the selected autofocus sensor.

Focus Mode: Single Servo, Continuous Servo, and Auto Select

On the top right side of the camera is another button, labeled **AF**. If the camera isn't set to manual focus, this button controls the Focus mode the camera uses. A Focus mode controls the manner in which the camera attempts to find and track a subject.

Each press of the **AF** button moves you to the next Focus mode option (with the last one returning you to the first). (You can also hold down the button and turn the Rear Command dial to change options.) You have three options:

AF-A Auto select (the default setting)
AF-S Single Servo AF
AF-C Continuous Servo AF

Top LCD: 

Let's take a close look at the differences between these three Focus modes (I'm going to address them out of order for a reason that'll become more clear when we get to the last one):

- **AF-S** *Single Servo AF*
  The camera finds focus once and locks on that as long as the shutter release is held partway. A picture is never taken unless focus is achieved. Put another way, when you fully press the shutter release the actual shutter

opening is delayed until focus is achieved. The camera assumes that the subject is not moving. In low-light or low contrast conditions where the camera has a hard time detecting focus, there may be a lag between pressing the shutter release and the taking of the picture. In practice, the D80's autofocus sensors are so good that such lag rarely happens. About the only time I've seen it is in low light situations where there is also very little contrast.

- **AF-C** *Continuous Servo AF*
  The camera looks for focus the moment the shutter release reaches the halfway point and continues to monitor focus as long as the shutter release is held partway. If a subject starts to *move after focus was established*, focus still follows the subject. However, a picture is always taken immediately when the shutter release is fully pressed, *even if focus hasn't yet been achieved*. That doesn't necessarily mean that the image will be out of focus, though. Remember, the camera has a calculation of where the focus point is and has instructed the lens to get there. Due to the brief delay in the time between pressing the shutter release and the opening of the shutter, the lens may have finally gotten to the right spot during that time. Indeed, for the fast focusing AF-S lenses, that's often the case.
- **AF-A** *Auto Select AF*
  The camera chooses whether to use Single Servo or Continuous Servo. Basically, the camera starts in Single Servo Focus mode. But if it thinks the subject is moving, it *might* switch to Continuous Servo Focus mode.

It's very important to note the primary difference between the Single Servo and Continuous Servo Focus modes. Nikon calls the Single Servo Focus mode "focus priority" for a reason—an image is not taken until the camera achieves focus. If the conditions are such that the camera can't manage to find focus—as sometimes happens with fast moving off-center subjects in low light—you won't be able to take a picture.

Continuous Servo Focus Mode is called "release priority" by Nikon, meaning that the picture is taken immediately after

fully pressing the shutter release, regardless of whether or not focus has yet been achieved. That doesn't mean the resulting picture is out of focus, however. As I've already noted, usually the camera has enough time to move the focus point on the lens. Sometimes depth of field is enough to cover any focus error. And sometimes you just get lucky. But under release priority, there's no *guarantee* that you'll get an in-focus image if you didn't first press the shutter release partway and hold it there long enough for the camera to establish a focus point.

Auto Select Focus mode tries to bridge the differences between the two modes by automatically detecting whether a subject is moving or not. For non-moving subjects, focus gets priority, while for moving subjects, the shutter release gets priority.

I sometimes mockingly refer to Single Servo AF as the Shutter Frustration mode and Continuous Servo AF as the Focus Frustration mode. That's because until you learn how the Nikon AF system works and can anticipate and avoid the things that keep it from achieving focus, you'll be frustrated that the shutter release never quite works in a timely fashion if you're in one autofocus mode and you never quite get in-focus pictures when you're in the other. If you always shoot in bright light, you might never encounter those problems, but I strongly suggest to every Nikon newcomer that they actually practice focusing in a variety of conditions with the various camera settings.

The autofocus area that is used as the initial focus point is set by:

1. Moving the Focus Area Selector Lock lever to the unlocked position (lever up to the dot position).
2. Making sure the camera is active (pressing the shutter release partway and releasing it if the camera isn't active).
3. Pressing the keys (edges) on the Autofocus Direction pad to change sensors (by default, the directions don't

wrap around, so pressing left continuously just takes you to the left sensor and stops (see "CSM #20, Focus Area Selection Wrap" on page <427>).

Autofocus Area Modes

The D80 also has three Autofocus Area modes, which determine how the eleven individual autofocus sensors are used.

The Autofocus Area mode is set by with Custom Setting #2 (see "Autofocus Area Modes" on page <399>). Your choices are:

- *Single Area AF*—the camera uses only the currently selected autofocus sensor for focusing. You control which sensor is used to focus by pressing the keys of the Direction pad on the back of the camera (when the meter is active). The active sensor lights up to indicate that you've chosen it.
- *Dynamic Area AF*—the camera starts by focusing on the subject under the currently selected autofocus sensor, but may move to use another sensor if it detects that the subject is moving. You control which sensor the system *starts* focusing with by pressing the keys of the Direction pad on the back of the camera (when the meter is active). Again, the active, starting sensor lights up to indicate that you've chosen it.
- **[■]** *Auto Area AF*—the camera focuses using the sensor that detects the "subject" closest to the camera *and* which has enough contrast with which to obtain focus; you get no choice in which autofocus sensor will be used for focusing. Note the compound construct in the first sentence in this description! There may be sensors on objects that are closer to you than the one that is used for focus by the camera, but if they have no contrast (a plain black dress would be a good example) they won't be used for focus. Note that the D80 will show you which sensor is used for focus by highlighting it.

The Autofocus Area mode is set using Custom Setting #2 (see page <399>).

Assuming that you haven't turned on Auto Area AF (it's used by most Scene exposure modes by default), the autofocus area that is used as the initial focus point is set by:

1. Make sure the camera is active (press the shutter release partway and release it if the camera isn't active).
2. Press the keys on the Autofocus Direction pad to change sensors. The directions don't wrap around (at the default camera settings; you can change this using Custom Setting #20; see page <427>), so pressing left continuously just takes you to the leftmost sensor and then stops. To then get to the rightmost sensor you'll need to press the ▸ portion of the Direction pad four times.

Autofocus Summary

Yes, the autofocus system used in the D80 is quite complex and a bit difficult to understand at first. Here's a table that summarizes the key options:

Autofocus Settings Summary

Focus Mode (top button)	*AF Area Mode (CSM #2)*	*Focus Area Selected by*	*Top LCD Display*	*Active Area Shown?*
Single Servo	Single Area	User		Yes
Single Servo	Dynamic Area	User		Yes
Single Servo	Auto-area	Camera		No
Cont Servo	Single Area	User		Yes
Cont Servo	Dynamic Area	User		Yes
Cont Servo	Auto-area	Camera		No
Auto Servo	Single Area	User		Yes
Auto Servo	Dynamic Area	User		Yes
Auto Servo	Auto-area	Camera		No

The big problem most first time D80 users have is that the Scene exposure modes also select autofocus settings. This news is sort of buried in the manual ("At default settings, the focus area is selected automatically in…"). You need to sometimes change the Focus Mode and/or the AF Area Mode after you've switched to one of the Scene exposure modes. Beyond that, there's the issue of confusing terminology: there's AF-A (auto) for Focus mode, and Auto-area for AF Area mode. Auto, auto, auto. There auto be a law against using the words "auto" and "mode" over and over again (let alone having "AF-S" stand for two different things).

Let's try to put this all in a simpler perspective. You really only have to set two things:

- You control whether a subject is followed and whether the camera will release the shutter release before achieving focus by setting the Focus mode (with the button on the top right of the camera). If focus is your priority over shot timing, use Single Servo (**AF-S**) or consider Auto Servo (**AF-A**). If shot timing is your priority over precise focus, use Continuous Servo (**AF-C**) or consider Auto Servo (**AF-A**).
- You control which sensor is being used to focus by setting Custom Setting #2. If you want full control, choose **Single area**. If you want the camera to follow subjects but start with your selected sensor, choose **Dynamic area**. If you want the camera to make all the sensor choices, select **Auto-area AF**.
- Just remember that choosing a Scene exposure mode can sometimes override your choices.

Autofocus Assist

The D80 has the dreaded built-in Autofocus Assist lamp that all the Nikon consumer cameras feature, which, in theory, is there to help the camera focus in low light situations. Unfortunately, it's generally more hassle than it's worth:

- *The location is poorly chosen*. If your hand doesn't block the light, the lens usually does the job. The D80 manual lists a number of lenses that block the sensor for distances shorter than 3' (1m), but in practice I've found that optimistic; more lenses block the sensor than Nikon claims, and if you use lens hoods the situation is worse.
- *Some lenses turn it off!* The 80-200mm f/2.8 AF-S lens and most of the VR lenses disable the function (the 18-200mm and 24-120mm VR lenses are exceptions, and do not turn off autofocus assist).
- *Some Scene exposure modes turn it off!* Landscape, Sports, and Night Landscape exposure modes turn the lamp off.
- *The range is minimal*. Beyond about 10' (3m), the light isn't strong enough to make a difference.
- *The light is annoying to subjects*. Do *you* like having a strong white light shined in your face just before being photographed?
- *Settings must be correct for it to work*. You must be in **Single area** or **Auto-area AF** Autofocus Area mode or you should be using the central autofocus sensor for **Dynamic area**. And Continuous Servo (**AF-C**) Focus mode turns the light off.
- *The lamp may turn itself off if it gets hot*. The lamp can't be used continuously. So if you're using the lamp constantly, it'll eventually shut down until it cools. I can usually get that to happen within five or six shutter release presses.
- *It uses more power*. When the lamp is lit the camera is using a minimum of another 20mA in power. While that figure is relatively low, multiple activations will certainly drain the battery faster, and in low light you may be activating the light repeatedly.

If you're getting the idea that I don't like the Autofocus Assist lamp on the D80, you're right. Fortunately, you can turn it off (see "CSM #4, Autofocus Assist Light" on page <402>).

If you have an SB-600 or SB-800 mounted on the D80, the camera will use the Autofocus Assist lamp *on the flash* unless you turn that feature off at the flash. In very low light conditions, the wide red focus pattern thrown by the Speedlight SB-600 and SB-800 makes the D80 almost eerily accurate in focus, but even without it the camera does just fine in virtually any situation you could handhold.

Manual Focus

You can focus lenses manually on a D80. With many older Nikkor lenses you'll need to move the Focus Mode lever on the front of the D80 to the **M** (manual) position to do so. With recent AF-S lenses, you can usually focus manually at any time by simply turning the focus ring. Nikon's professional lenses typically have a Manual/Autofocus switch (or ring switch on older lenses) that can be used [106].

When you focus manually, the D80 still provides a focus aid that's useful: the focus indicator at the far left of the viewfinder information display displays • if your focus is correct. Regardless of the autofocus sensor chosen and highlighted, the central autofocus sensor is what is used to confirm focus when set to manual focus.

Only a couple of caveats exist for this manual focus confirmation function:

- The lens must have a maximum aperture of about f/5.6 or faster. (In high contrast situations, sometimes you can get by with a lens that only opens up to f/8, but don't count on it.)
- If you use teleconverters or extension tubes, the effective aperture must be f/5.6 or faster. Again, sometimes an effective aperture of f/8 works, but don't count on it—at best, autofocus will be slow to lock on.

[106]This switch is (somewhat confusingly) labeled **M/A** for the autofocus position, **M** for the manual focus position on AF-S lenses. The "M/A" is trying to tell you that the lens will autofocus but you can override it with manual focus at any time by turning the focus ring.

In both of the above cases, you must not be manually stopped down (e.g. have set an aperture of f/11 *on the lens aperture ring*).

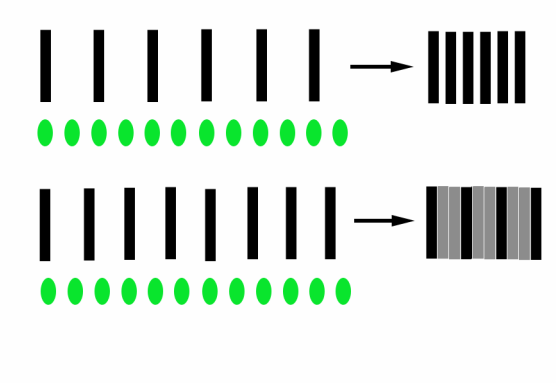
Note that older AI and AI-S manual focus lenses do not meter with the D80, and that you have to put the Mode dial in the Manual exposure mode position (**M**).

Sharpening

While technically not a "focusing" action, image sharpening algorithms can increase the apparent acuity of a photo taken with the D80.

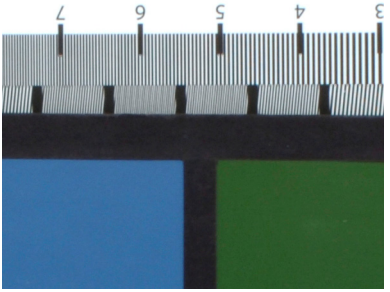
Why is it necessary to sharpen images if the camera is focusing correctly? The process of translating analog information (light) into digital data (pixels) involves a procedure called sampling. Edges of sampled objects tend to be rendered in a manner that looks slightly fuzzy to our eyes. (If you want to know more about why this is, get *The Manual of Photography, 9th Edition*. But be forewarned, analog-to-digital transformation is filled with mathematical concepts and some pretty intimidating formulas).

The short version: If the frequency of detail in a scene is higher than the sensor can sample, the detail is under-sampled and combined into a single pixel, and sharp edges tend to gather data from either side.) Sharpening uses contrast adjustments at edge boundaries to trick our eyes into seeing clearly defined edges.



If the green dots are photosites on the sensor and the black lines high contrast detail, when a line falls perfectly on a photosite (top), we get a perfect rendering. If some detail falls on multiple sensors (bottom) the detail is blurred.

While you might not have realized this, you've seen those "beat" patterns before in this book in some of the sample shots for various settings:



In the top row of resolution patches just to the left of the seven you can see some irregularity as the frequency of the detail starts to exceed the capture ability. You can see it even more clearly in the second row of diagonal line resolution samples below the 5, 6, and 7.

The usual technique for sharpening images is to apply a technique called "unsharp masking," and a variation of that technique is used by the D80. Unsharp masking finds edges by looking for adjacent pixels with value differences. On the brighter side of the edge, unsharp masking lightens the pixels; on the darker side, it darkens the pixels.

Unsharp masks work by exaggerating edges. I started with a medium gray block on the left and a dark gray block on the right, and then applied an Unsharp Mask. Note how on the lighter side of the image the edge was made even lighter, while on the dark side of the edge it was made almost black.

Most unsharp mask filters have settings for amount (controls how much lighter or darker the values are made), radius (controls how wide an area over which the value shifts are made), and threshold (controls how much of a difference there must be between adjacent pixels before adjustments are made). The D80 doesn't let you set the individual parameters of the sharpening control; instead, you set an overall "level."

The D80 has seven **Image sharpening** settings:

None—no sharpening changes are made to the digital data.

Low—a small amount of unsharp masking is applied to the image. Nikon gives no details on how much sharpening is done, but on the D1 they claimed this setting was equivalent to about a 40% Amount setting in Photoshop.

Medium low—a little more sharpening than **Low**.

Normal—a moderate amount of unsharp masking is applied to the image. Again, the D80 documentation makes no claims to the amount, though the D1 documentation claims that this is about equivalent to the 80% Amount setting in Photoshop. Under extreme magnification, the camera's rendition is cruder and more readily detected than Photoshop's, though (probably due to the radius chosen).

Medium high—a little more sharpening than **Normal**.

High—a large amount of unsharp masking is applied to the image. On the D1, Nikon claimed this is about equivalent to the 120% Amount setting in Photoshop.

Auto—the camera decides what level of sharpening to use. The manual says that this is based upon the "subject" and "vary shot to shot," which isn't very helpful in understanding what the camera might be doing.

Note: While I've given the relative Photoshop amounts Nikon claimed for the D1, it appears that the D80 uses less intensive settings, probably to keep noise from becoming an issue.

Note: If you're shooting JPEG images, the above parameters are used to apply sharpening to the actual pixel data that is saved in your image file. If you shoot NEF, the "tag" for the sharpening value is stored in the EXIF data and the data is left untouched. However, note that programs such as Nikon Capture NX often use the camera tags as the default setting for conversion, so unless you override the sharpening value in your NEF conversion program, sharpening may be applied by the program! That's one reason why I sometimes suggest setting sharpening to **None** *if you shoot NEF images.*

Sharpening is usually applied twice to images (only one of these potentially occurs in camera). The first sharpening is used to compensate for the anti-aliasing (fuzziness) that is inherent in digital image acquisition due to high frequency sampling. I'd argue that this sharpening should be minimized as much as possible.

A final sharpening should only be applied to an image when you know the reproduction size. For example, I often use a **Radius** value of **0.3** to **0.5** when sharpening small images destined for the Web or computer view. When printing on an Epson inkjet printer, such as the 1800 or 2400, I sometimes use **Radius** values as high as **0.8** to **1.2**, since I know that the ink tends to spread upon contact with the paper I use, masking the sharpening effect somewhat. (The dot gain on most consumer Epson printers with regular ink and papers is about 30%.) Another photographer I know applies Photoshop **Unsharp Mask** values of **4**, **50**, **4** for the D80 (Radius, Amount, Threshold). What you use depends on your output device and the way you balance visual impact with artifacts.

Many photographers also believe that it's incorrect to apply sharpening to color image data (amongst other problems, the colors can shift due to the methods used to lighten or darken edges). These folk tend to advocate switching the image mode to Color Lab (**Adjust/Mode/Color Lab** in Photoshop), applying sharpening only to the luminosity layer, then switching back to RGB or CYMK mode (**Adjust/Mode/RGB** or **Adjust/Mode/CYMK**). This method also tends to color shift images, though not by as much as the regular method, as Photoshop rounds pixel values during mode conversions. I've seen some colors drift by 2 or 3 values (out of 256) during this conversion. (For a fuller discussion of sharpening, see http://www.bythom.com/sharpening.htm.)

Tip: *In most recent versions of Photoshop, you can run your* **Unsharp Mask** *filter as usual, then select* **Fade Unsharp Mask** *from the* **Edit** *menu (select* **Luminosity** *in the* **Mode** *pop-up) to achieve the same effect as the Color Lab luminosity trick. This avoids the color shift.*

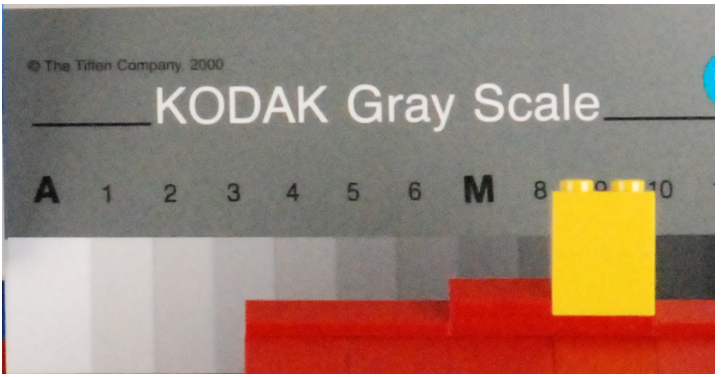
It makes sense to use in-camera sharpening when you're working under tight deadlines and know how the image is likely to be rendered. For example, photographers shooting on deadline for Web sites or newspapers often fall into this category, and should probably select **Normal** or **Medium High** sharpening, depending upon whether the scene is normal contrast or low contrast, respectively). But be careful if you venture above ISO 400, as sharpening interacts with noise and can create unusable images. Note also that high levels of sharpening also tend to increase the size of JPEG files, as sharpening increases detail that's difficult to compress.

My recommendation for most users who aren't shooting on deadline is that you turn Sharpening to **Normal** or **Medium Low** when shooting with a D80 in the JPEG file format. This gives you modestly sharp images for direct view that can be re-sharpened as necessary for other output formats.

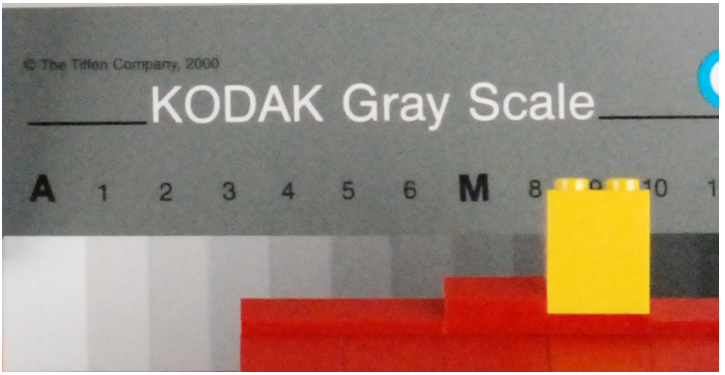
Tip: *On the other hand, setting sharpening to a high value allows you to use the camera's zoom review function to assess focus, and the high sharpening values aren't bad on the D80 at the low ISO values. I'll often use a value of* **High** *when I'm trying to assess focus in the field.*

NEF files don't get sharpened by the camera, but you should still set the camera to a value of **None** so that your conversion program doesn't pick up a sharpening value by default. Not only does Photoshop (and other image editing programs) do a better job sharpening images than the D80 does, but you can choose your sharpening methodology based upon how the image is used.

Note: *If you've set a sharpening level on the D80, it is applied by default to NEF format files in Capture NX if you've left it at the default settings This is yet another reason to turn sharpening OFF on the camera (that way the camera's settings match what you get).*



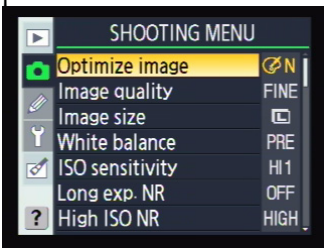
Sharpening set to **Low**. Note the slight fuzziness (antialiasing) in the edges of the lettering.



Sharpening set to **High**. Is the lettering better, or worse? Surprisingly, only a little better. Nikon has elected to be more conservative on the range they've given us on the D80 than on some previous Nikon DSLRs. Note that the overall contrast has increased slightly (the white "Kodak" is whiter), and that the noise is slightly more distinct (these examples were shot intentionally at ISO 1600 to show that).

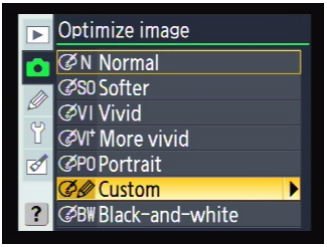
To set sharpening:

1. Press the **MENU** key to show the menu system.
2. Use the Direction pad to navigate to the SHOOTING menu (the camera icon tab).
3. Use the Direction pad to navigate to the **Optimize image** option and press the ▸ key on the Direction pad or the **OK** button to select it.



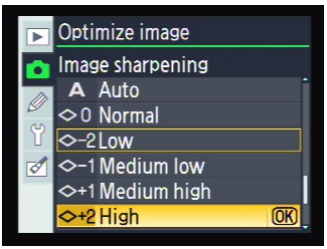
4. Use the Direction pad to navigate to the **Custom** option and press the ▸ key on the Direction pad or the

OK button to select it.

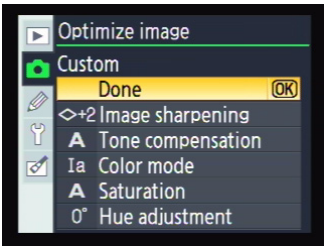


5. Use the Direction pad to navigate to the **Image Sharpening** option and press the ▸ key on the Direction pad or the **OK** button to select it.

6. Use the Direction pad to navigate to your choice and press the ▸ key on the Direction pad or the **OK** button to select it.



7. Use the Direction pad to navigate to **Done** and press the ▸ key on the Direction pad or the **OK** button to select it.



Shooting Controls

Many of the shooting controls of the D80 have already been covered in earlier sections, but a few important ones remain to be described.

Shutter Releases

The D80 sports the usual shutter release at the right-front top of the camera. If you're using an MB-D80 mounted to your camera, there is a second release for when you hold the camera for vertical shots. Both releases have Front and Rear Command dials. An **AE-L/AF-L** button is also available for both releases.

Note that the shutter release on the MB-D80 has a lock ring around it. When the dot on the ring is aligned with the white line on the body, the vertical release is active; otherwise it is inactive. Get used to flipping that Vertical Release Lock switch; if left unlocked, you're pretty much guaranteed of getting random pictures you didn't want as your hand and other things brush by the vertical release.

Personally, I rarely use the MB-D80 and its vertical release. I, like many professionals, use quick release mounts on my cameras (most of the time the camera is used on a tripod). I have an L-bracket mounted on my cameras most of the time. So when I grasp the camera to shoot vertically as Nikon intends me to, my palm then rests uncomfortably on the mount. It also doesn't help that it takes relatively large hands to also feel comfortable with the location of the Direction pad when shooting verticals. Long ago I learned how to shoot vertical with only one release, so that's all I tend to use.

The shutter releases control the activation of the camera's metering system and (usually) the start of autofocus (basically, all systems that need to be "active" during shooting). A partial press of the shutter release turns metering on and activates the autofocus system. Unlike consumer cameras, holding a shutter release partway doesn't lock exposure (unless you've set Custom Setting #19). As long as you hold the shutter

release partway down, the camera stays active (and uses considerably more power, see "Battery Life" on page <97>).

If you let go of the shutter release after pushing it partway, the camera stays active based upon how Custom Setting #28 is set (see "Meter/Camera Active Time" on page <438>). By default, this is six seconds.

Shutter Lag

One thing that catches D80 users unawares is the potential for "lag" in the time between pressing the shutter release and the picture being taken. Since many users purchase the D80 for its speed, this can be a frustrating aspect of the camera, at least until you understand that the settings you choose contribute to the problem.

In manual focus and manual exposure mode with no images in the internal memory buffer, the 80ms shutter lag on a D80 is a bit longer than that of the D200 or the D2 series (55ms on the D200, 37 ms on the D2 series). That's still better than other Nikon bodies (the D70 series had a 106ms shutter lag, for example). For a consumer DSLR, the D80 has very little shutter lag.

However, as you turn on automated features or put images into the buffer, the lag may actually become significant and difficult to predict.

Here's a partial list of things that contribute to shutter lag:

- *The camera needs to clear the buffer*. In the Continuous shooting method (see "Frame Advance" on page <343>), when the internal memory buffer fills, the D80 must write that information to the Secure Digital card. As enough internal memory becomes available for another image, the D80 again releases the shutter. Fortunately, the D80's buffer is adequate in size and its write speed to storage is fast, so it's rare that you'll encounter buffer delays, but it *is* possible, especially if you shoot NEF format in rapid bursts or use an older, slower Secure Digital card.

- *Autofocus is set to Single Servo*. In low contrast scenes and sometimes with moving objects, the autofocus mechanism may take longer than usual to lock into the focus point. If you've set Single Servo AF, the camera won't release the shutter until autofocus is achieved. With telephoto lenses that do not have a built-in motor (i.e. are not AF-I or AF-S), the number of turns the autofocus motor has to make to drive a lens from one extreme focus position to another can also be a factor (generally you don't see this with wide angle lenses).
- *The shutter speed is long*. In continuous motor drive, it is possible for long shutter speeds to reduce the camera's frame rate. While this doesn't contribute lag to the initial frame in a burst, you may feel like subsequent frames have a built-in lag. Consider, for example, that you have the camera set to shoot continuously and are using a shutter speed of ½ second. Obviously, the absolute best you're going to get is something less than 2 frames per second, not the 3 frames per second maximum rate of the D80.
- *You've told the camera to pause!* Custom Settings #31 causes the camera to wait 0.4 seconds before opening the shutter.
- *The self timer is set*. See "Self Timer" on page <345>. This one is my favorites at workshops: the student comes to me and says their camera isn't working. About that point the shutter goes off and the student remembers that they set the self timer.
- *i-TTL flash is active*. Since the preflash is measured by the 420-element CCD in the viewfinder, the mirror has to be down while preflash signals and responses are made. With a single flash this usually isn't an issue, as the D80 flips its mirror up rather quickly. However, when you use multiple wireless i-TTL flashes, the preflash sequence lengthens, and this can cause a perceivable delay in shutter response.

Frame Advance

One of the D80's key attributes is its ability to take multiple photos in rapid succession. Most digital cameras are quite limited in this respect, but the D80 operates much like a D2 series body or an F6, though with a few minor differences and a significant performance drop.

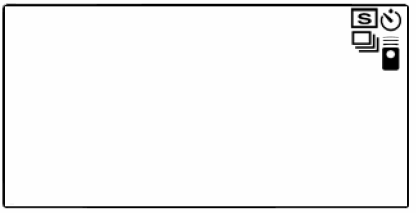
Two frame advance (shooting method) settings are possible (plus there are three additional related settings):

S *Single-frame*. Each time the shutter release is pressed, a single image is recorded (i.e. holding the shutter release down past the shot doesn't take additional pictures). You can take additional pictures (until the buffer fills) without having to wait for the camera to write to the Secure Digital card—you just have to press the shutter release for each shot.

C *Continuous*. Images are recorded at a maximum of 3 frames per second (fps) while you hold the shutter release down. If the buffer fills and you continue to hold the shutter release down, the D80 shoots another picture each time one image has been completely saved to the Secure Digital card.

Note: Nikon's motor drive specifications are made with the camera set to manual exposure, manual focus, and a shutter speed of 1/250 second or faster. If you're using automatic exposure modes, slower shutter speeds, or light is too dim for optimal autofocus, you may experience frame rates lower than Nikon specifies.

To change the motor drive setting: Hold down the Frame Advance button and turn the Rear Command dial until **S** (Single Frame), (Continuous Frame), (self-timer, which is the same as single frame with a timed delay), or the remote option shows in the top LCD.

Top LCD: 

Since the D80 is so fast at emptying the buffer, you usually won't encounter any shooting limitations. However, note the following buffer sizes:

D80 Maximum Buffer Capacity

Image Format	*Maximum Exposures**
NEF	6 exposures
NEF (compressed)	6 exposures
NEF+JPEG	6 exposures
JPEG Fine Large	23 exposures
all other JPEG settings	100 exposures

**prior to the internal buffer filling*

If the buffer is full and you attempt to take another photo, the camera pauses until space for it is available.

Frame Advance Troubleshooting

Problem: In Continuous shooting method you can't achieve the maximum 3 fps frame rate.
Solution: Turn off **Long Exp. NR**. Turn off Automatic ISO. Both impact the maximum frame rate the camera can achieve. Make sure that you're using a shutter speed that can achieve 3 fps.

Problem: When set to either Continuous shooting method, the camera takes pictures at irregular intervals.
Solution: Single Servo autofocus is also set, and in this mode focus operations always have precedence over shutter release (e.g. the camera waits for the autofocus system to refocus the lens on a moving subject before releasing the shutter). Even in Continuous Servo autofocus the camera will sometimes

"hiccup" while focusing. Set the camera to manual focus and the camera takes pictures at regular intervals.

Problem: Rapid shooting with a flash produces inconsistent exposures.
Solution: You probably need to use a Speedlight with faster recycling properties, or you need to set the flash to one of its lower-power manual modes (many Speedlights can fire at high frame advance speeds when set to manual flash mode at reduced power; see my *Nikon Flash Guide* for more details). If you need to shoot with flash with rapid refresh, you should also look into getting the high voltage power option for your Speedlight. For example, you can run both a D80 and an external Speedlight from either a Digital Camera Battery or a Quantum Turbo battery, with the Speedlight being powered at 24v by the battery for faster cycling.

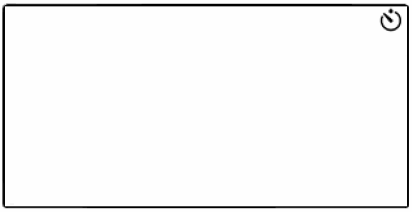
Problem: The D80 shoots at a slower frame rate when the background is dark (as compared to scenes with light backgrounds).
Solution: Most recent Nikon bodies exhibit this characteristic. Nikon has not released an explanation for the phenomenon. Switching to manual exposure mode does not change the behavior. Your only choice is to light the background.

Problem: The D80 shoots at a slower frame rate when noise reduction is turned on.
Solution: This is normal. Turn off the noise reduction.

Self Timer

The D80 features a variable self timer, which delays the opening of the shutter after the pressing of the shutter release.

To turn the self timer ON: hold down the Frame Advance button and turn the Rear Command dial until appears in the top LCD. Or press the Frame Advance button repeatedly until appears.

Top LCD: 

When the self-timer is set, the camera blinks the white lamp on the front of the D80 from the time you press the shutter release until two seconds prior to the exposure, at which point the camera turns the light on continuously to warn you that the exposure is about to be taken. If you've turned Beep on (CSM #1), you'll also hear audible beeps along with the blinking of the white lamp.

📷 To set the delay value the self timer uses, see "Custom Setting #29, Self Timer Delay Setting" on page <439>. Note that unlike some Nikon bodies, the D80 only allows settings of 2, 5, 10, or 20 seconds.

Using the self-timer has a few hidden "gotchas" you should be aware of:

- *Autofocus is attempted immediately upon shutter release*. If you stand in front of the camera and press the shutter release (as you might do before assuming your position away from the camera in a self-portrait), the camera focuses on you standing just in front of the camera; it doesn't wait until you have assumed your position and the delay has completed! I always trigger self-timer shots from alongside the camera, and then move to position in front of the camera; alternatively, I'll move the autofocus selector switch to manual focus. Note further that if you've selected Single Servo autofocus, the self timer countdown doesn't begin until focus is achieved. The corollary is that if focus isn't achieved, the self timer isn't started.
- *Exposure may be wrong in automatic exposure modes*. Stray light can enter the viewfinder and influence

exposure settings when using the self timer. Be sure to use the Eyepiece cap on the viewfinder if you won't be looking through the camera when the exposure is taken (or use manual exposure mode). And yes, this is a real problem—I've seen exposures vary by more than a full stop! Use the DK-5 accessory to block light coming in from the viewfinder.

- *Bulb can't be used with the self timer*. The D80 automatically cancels bulb shutter speeds and uses 1/10 second instead. (bULb still appears as the shutter speed on the top LCD!)
- *If you press the Depth of Field Preview button while the self timer is active and counting down, the self timer is cancelled*[107].

Remote Control

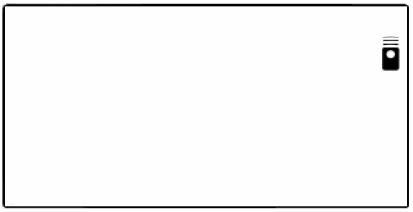
The D80 has two remote shutter release options. The first is the optional MC-DC1 remote cable (also used on the D70s), which plugs into the bottom connector on the left side of the camera (as you face the back). This simple wired remote has a shutter release button with a lock (for long exposures using bULb). The shutter release on the MC-DC1 otherwise functions exactly as the main shutter release on the camera, and frame advance works as usual.

A second optional, *wireless* remote control is available for the D80. The ML-L3 remote is the same as used for the N75, D50, and D70 series, and is fairly simple in operation. Unlike the wired remote, you'll need to make frame advance settings specific to the remote use in order to use it.

You can do two things with the ML-L3 remote:

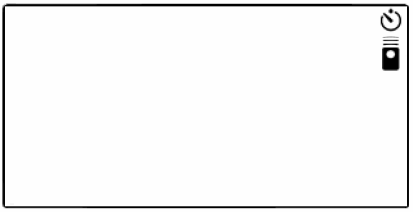
[107] Someone somewhere at Nikon seems to be reading my eBooks. On the D200 there's a bug that keeps the button from working when the self timer is active. The only place I've *ever* seen this mentioned is in my D200 eBook, and it's not a likely combination someone would try, yet here we are one camera down the line and the bug is fixed.

- Trigger the shutter release immediately (Nikon calls this the Quick Response mode). To set this, hold down the Frame Advance button and rotate the Rear Command dial until only the remote icon appears on the top LCD. Alternatively, press the Frame Advance button repeatedly until the remote icon appears.

  Top LCD: 

  Special note for long exposures: when the D80 is set in Quick Response mode, instead of the bULb shutter speed you'll get a -- shutter speed (you also have to be in Manual exposure mode to get this). The -- shutter speed is started with the first press of the button on the ML-L3 remote and ends with a second press (or after 30 minutes, whichever comes first) [108].

- Trigger the shutter release with a delay of two seconds (Nikon calls this the Delayed Remote mode). To set this, hold down the Frame Advance button and rotate the Rear Command dial until both the self timer and remote icon appear on the top LCD. Alternatively, press the Frame Advance button repeatedly until the remote and self timer icons both appear.

  Top LCD: 

When the camera is set to either method of remote release, the camera automatically cancels that after a period of inactivity. By default this length of time is one minute, but you

[108] While you may be tempted to use this for cleaning the CCD, I don't recommend it.

can change it with Custom Setting #30 (see "Remote Active Setting" on page <440>). Also, as with the Self Timer, you should cover the eyepiece with the DK-5 accessory if you're not looking through the viewfinder.

Note: The internal flash must fully recharge before you can take another picture with the remote release, so if you used flash on a shot, it may take a few seconds before another press of the remote's button triggers another picture.

Depth of Field Preview

The D80 features a Depth of Field Preview button that closes down the aperture to the one that will be used during exposure. This allows you to see the approximate depth of field of the final image.

Note: Immediately after you've taken a picture, the Depth of Field Preview button doesn't always work (you can hit it too soon after the previous exposure was taken). Press the shutter release partway to establish an exposure, and then retry the button.

Many D80 users question whether depth of field on a D80 is the same as on a 35mm film body (assuming the same lens, focus point, and aperture settings). After dealing with this issue for years on D1, D50, D70, D100, D200, and D2 models, I can state conclusively that the answer is "no."

Depth of field in the 35mm film world is often calculated as follows:

$$NearFocus = \frac{Distance}{\left(1 + \left(Distance * \left(\frac{Aperture}{1000}\right) * FocalLength\right)\right)}$$

$$FarFocus = \frac{Distance}{\left(1 - \left(Distance * \left(\frac{Aperture}{1000}\right) * FocalLength\right)\right)}$$

But conservative photographers also take into account the amount of magnification that the final image undergoes. An 8 x 10″ print from a D80 comes from a smaller imaging area than a print from a 35mm film negative, thus undergoes more magnification. Details that were small enough to pass as in focus to our eye at normal viewing distances may appear out of focus when magnified.

I could present a long theoretical discourse and accompanying math regarding the differences between 35mm film and the D80, but that's a bit beyond the scope of this book. Instead, I'll present my conclusion: depth of field appears to me to be a bit less than a one stop difference for a D80 than 35mm film, at least for the sized prints that you're likely to produce (11 x 14″ or smaller).

So, if you're using depth of field or hyperfocal distance charts intended for 35mm film cameras with your D80, simply add a stop for a conservative approach. For example, if your 35mm film chart says that the hyperfocal distance is 50 feet for a 50mm lens at f/2 (which it should if it uses the conservative Zeiss circle of confusion value!), simply use f/2.8 on the D80.

Note: The depth of field markings on most Nikkor lenses appear to be calculated using a circle of confusion of 0.03, with a few older ones possibly using 0.033. Carl Zeiss suggested that the circle of confusion should be 1/1730th of the diagonal measurement of the frame, which for 35mm would be 0.025. That's the value that I, and many other professionals, use for 35mm. For a D80, the Zeiss number would be 0.016 (technically 0.016416, but I round down). Since the penalty for goofing up depth of field is an unpublishable image, it pays to use conservative values.

The tables that follow are calculated for the D80 using the 0.016 circle of confusion value, and use distances in feet.

18mm Lens

	Aperture									
Distance	2.8	3.5	4	5.6	8	11	16	22	32	
0.5	0.49	0.49	0.49	0.48	0.47	0.47	0.45	0.44	0.41	near
	0.51	0.51	0.51	0.52	0.53	0.54	0.56	0.59	0.63	far
1	0.96	0.95	0.95	0.93	0.90	0.87	0.82	0.76	0.69	near
	1.04	1.05	1.06	1.09	1.13	1.18	1.29	1.45	1.83	far
2	1.85	1.81	1.79	1.72	1.62	1.51	1.36	1.22	1.03	near
	2.18	2.23	2.26	2.39	2.61	2.95	3.76	5.60	30.83	far
3	2.67	2.60	2.55	2.40	2.22	2.02	1.76	1.52	1.24	near
	3.42	3.55	3.65	3.99	4.65	5.85	10.29	115.92	Infinity	far
5	4.14	3.97	3.85	3.53	3.13	2.75	2.28	1.90	1.48	near
	6.32	6.76	7.12	8.57	12.35	27.52	Infinity	Infinity	Infinity	far
10	7.05	6.56	6.26	5.44	4.55	3.78	2.95	2.33	1.73	near
	17.21	21.00	24.92	61.78	Infinity	Infinity	Infinity	Infinity	Infinity	far
20	10.87	9.75	9.09	7.46	5.88	4.65	3.45	2.63	1.89	near
	125.49	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	far
50	16.10	13.77	12.48	9.60	7.13	5.39	3.84	2.85	2.00	near
	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	far
hyperfocal	23.7	19.0	16.6	11.9	8.3	6.0	4.2	3.0	2.1	

20mm Lens

	Aperture									
Distance	2.8	3.5	4	5.6	8	11	16	22	32	
0.5	0.49	0.49	0.49	0.49	0.48	0.47	0.46	0.45	0.43	near
	0.51	0.51	0.51	0.52	0.52	0.53	0.55	0.57	0.60	far
1	0.97	0.96	0.96	0.94	0.92	0.89	0.85	0.80	0.73	near
	1.03	1.04	1.05	1.07	1.10	1.14	1.22	1.33	1.57	far
2	1.88	1.85	1.83	1.77	1.68	1.59	1.45	1.32	1.14	near
	2.14	2.18	2.21	2.30	2.47	2.70	3.21	4.16	8.16	far
3	2.73	2.67	2.62	2.50	2.33	2.15	1.91	1.68	1.40	near
	3.33	3.43	3.50	3.75	4.20	4.95	7.02	14.10	Infinity	far
5	4.28	4.13	4.03	3.74	3.38	3.01	2.55	2.15	1.71	near
	6.01	6.33	6.59	7.54	9.64	14.79	134.44	Infinity	Infinity	far
10	7.47	7.02	6.74	5.96	5.08	4.29	3.40	2.73	2.05	near
	15.13	17.36	19.40	31.10	324.78	Infinity	Infinity	Infinity	Infinity	far
20	11.90	10.81	10.14	8.47	6.79	5.44	4.09	3.15	2.28	near
	62.63	134.10	724.89	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	far
50	18.48	15.97	14.55	11.34	8.52	6.49	4.65	3.47	2.44	near
	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	far
hyperfocal	29.3	23.4	20.5	14.6	10.3	7.5	5.1	3.7	2.6	

24mm Lens

	Aperture									
Distance	2.8	3.5	4	5.6	8	11	16	22	32	
0.5	0.50	0.49	0.49	0.49	0.49	0.48	0.47	0.46	0.45	near
	0.51	0.51	0.51	0.51	0.51	0.52	0.53	0.54	0.56	far
1	0.98	0.97	0.97	0.96	0.94	0.92	0.89	0.85	0.80	near
	1.02	1.03	1.03	1.05	1.07	1.09	1.14	1.21	1.33	far
2	1.91	1.89	1.88	1.83	1.77	1.70	1.59	1.47	1.32	near
	2.10	2.12	2.14	2.20	2.30	2.44	2.70	3.12	4.17	far
3	2.81	2.76	2.73	2.63	2.50	2.36	2.15	1.94	1.67	near
	3.22	3.28	3.33	3.48	3.74	4.12	4.97	6.58	14.40	far
5	4.48	4.36	4.29	4.05	3.75	3.43	3.00	2.61	2.14	near
	5.66	5.85	6.00	6.52	7.50	9.23	15.01	60.17	Infinity	far
10	8.10	7.73	7.48	6.80	5.98	5.20	4.27	3.51	2.71	near
	13.08	14.17	15.06	18.89	30.50	131.99	Infinity	Infinity	Infinity	far
20	13.58	12.57	11.94	10.28	8.51	7.00	5.41	4.24	3.13	near
	37.91	48.84	61.51	362.16	Infinity	Infinity	Infinity	Infinity	Infinity	far
50	22.90	20.16	18.58	14.85	11.41	8.85	6.44	4.85	3.44	near
	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	far
hyperfocal	42.2	33.7	29.5	21.1	14.8	10.7	7.4	5.4	3.7	

28mm Lens

	Aperture									
Distance	2.8	3.5	4	5.6	8	11	16	22	32	
0.5	0.50	0.50	0.49	0.49	0.49	0.49	0.48	0.47	0.46	near
	0.50	0.50	0.51	0.51	0.51	0.51	0.52	0.53	0.54	far
1	0.98	0.98	0.98	0.97	0.96	0.94	0.92	0.89	0.85	near
	1.02	1.02	1.02	1.03	1.05	1.07	1.10	1.14	1.22	far
2	1.94	1.92	1.91	1.88	1.83	1.77	1.68	1.59	1.45	near
	2.07	2.09	2.10	2.14	2.21	2.30	2.47	2.71	3.23	far
3	2.86	2.82	2.80	2.72	2.62	2.50	2.33	2.15	1.90	near
	3.16	3.20	3.23	3.34	3.51	3.75	4.22	4.98	7.13	far
5	4.61	4.52	4.46	4.27	4.02	3.74	3.36	2.99	2.53	near
	5.47	5.60	5.70	6.03	6.62	7.53	9.78	15.24	219.63	far
10	8.53	8.23	8.02	7.43	6.70	5.96	5.03	4.24	3.36	near
	12.09	12.75	13.27	15.27	19.73	31.07	734.07	Infinity	Infinity	far
20	14.85	13.95	13.37	11.81	10.05	8.47	6.71	5.37	4.03	near
	30.62	35.31	39.64	65.29	2209.63	Infinity	Infinity	Infinity	Infinity	far
50	26.75	23.96	22.30	18.26	14.35	11.32	8.38	6.38	4.57	near
	383.08	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	far
hyperfocal	57.4	45.9	40.2	28.7	20.1	14.6	10.0	7.3	5.0	

35mm Lens

	Aperture									
Distance	2.8	3.5	4	5.6	8	11	16	22	32	
0.5	0.50	0.50	0.50	0.50	0.49	0.49	0.49	0.48	0.48	near
	0.50	0.50	0.50	0.50	0.51	0.51	0.51	0.52	0.53	far
1	0.99	0.99	0.99	0.98	0.97	0.96	0.95	0.93	0.90	near
	1.01	1.01	1.01	1.02	1.03	1.04	1.06	1.08	1.13	far
2	1.96	1.95	1.94	1.92	1.89	1.85	1.79	1.72	1.61	near
	2.04	2.05	2.06	2.09	2.13	2.18	2.27	2.40	2.63	far
3	2.91	2.88	2.87	2.82	2.75	2.66	2.53	2.39	2.19	near
	3.10	3.13	3.14	3.21	3.30	3.43	3.68	4.01	4.74	far
5	4.74	4.68	4.64	4.51	4.33	4.12	3.81	3.50	3.08	near
	5.29	5.37	5.42	5.61	5.92	6.36	7.26	8.74	13.25	far
10	9.01	8.79	8.64	8.19	7.61	6.98	6.14	5.36	4.43	near
	11.24	11.60	11.87	12.83	14.60	17.64	27.01	74.63	Infinity	far
20	16.37	15.66	15.19	13.86	12.24	10.69	8.82	7.29	5.66	near
	25.70	27.67	29.27	35.93	54.57	155.07	Infinity	Infinity	Infinity	far
50	32.13	29.49	27.86	23.67	19.31	15.70	11.97	9.31	6.80	near
	112.67	164.08	243.41	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	far
hyperfocal	89.7	71.8	62.8	44.8	31.4	22.8	15.7	11.4	7.8	

50mm Lens

	Aperture									
Distance	2.8	3.5	4	5.6	8	11	16	22	32	
0.5	0.50	0.50	0.50	0.50	0.50	0.50	0.49	0.49	0.49	near
	0.50	0.50	0.50	0.50	0.50	0.50	0.51	0.51	0.51	far
1	1.00	0.99	0.99	0.99	0.99	0.98	0.97	0.97	0.95	near
	1.00	1.01	1.01	1.01	1.01	1.02	1.03	1.04	1.06	far
2	1.98	1.98	1.97	1.96	1.94	1.92	1.89	1.85	1.79	near
	2.02	2.03	2.03	2.04	2.06	2.08	2.12	2.17	2.26	far
3	2.95	2.94	2.94	2.91	2.87	2.83	2.76	2.67	2.55	near
	3.05	3.06	3.07	3.10	3.14	3.19	3.29	3.42	3.65	far
5	4.87	4.84	4.82	4.75	4.65	4.53	4.34	4.14	3.84	near
	5.14	5.17	5.20	5.28	5.41	5.58	5.89	6.31	7.16	far
10	9.49	9.37	9.29	9.03	8.67	8.26	7.65	7.03	6.20	near
	10.57	10.72	10.83	11.20	11.81	12.68	14.43	17.31	25.92	far
20	18.04	17.61	17.32	16.44	15.27	14.03	12.35	10.80	8.93	near
	22.43	23.13	23.66	25.53	28.97	34.83	52.53	134.68	Infinity	far
50	39.30	37.30	36.00	32.37	28.12	24.16	19.56	15.93	12.16	near
	68.71	75.80	81.83	109.78	225.15	Infinity	Infinity	Infinity	Infinity	far
hyperfocal	183.0	146.4	128.1	91.5	64.1	46.6	32.0	23.3	16.0	

70mm Lens

	Aperture									
Distance	2.8	3.5	4	5.6	8	11	16	22	32	
0.5	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	near
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	far
1	1.00	1.00	1.00	1.00	0.99	0.99	0.99	0.98	0.98	near
	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.02	1.03	far
2	1.99	1.99	1.99	1.98	1.97	1.96	1.95	1.93	1.89	near
	2.01	2.01	2.01	2.02	2.03	2.04	2.06	2.08	2.12	far
3	2.98	2.97	2.97	2.95	2.94	2.91	2.87	2.83	2.76	near
	3.02	3.03	3.03	3.05	3.07	3.09	3.14	3.19	3.29	far
5	4.93	4.92	4.91	4.87	4.82	4.75	4.65	4.53	4.34	near
	5.07	5.08	5.10	5.14	5.20	5.28	5.41	5.58	5.90	far
10	9.73	9.67	9.63	9.48	9.28	9.03	8.65	8.24	7.63	near
	10.28	10.35	10.40	10.58	10.84	11.20	11.84	12.72	14.52	far
20	18.96	18.71	18.54	18.01	17.28	16.44	15.21	13.96	12.27	near
	21.17	21.48	21.71	22.48	23.74	25.53	29.19	35.27	54.03	far
50	43.91	42.61	41.73	39.14	35.81	32.36	27.89	23.92	19.34	near
	58.05	60.49	62.36	69.20	82.83	109.90	241.26	Infinity	Infinity	far
hyperfocal	358.8	287.0	251.1	179.4	125.6	91.3	62.8	45.7	31.4	

Note: The Excel workbook used to calculate these tables is provided on the CD. All distances in the above charts are in feet, but the workbook also provides tables in meters, as well. The areas labeled in green are changeable by you, which mean that you can enter your own distances and apertures if the ones I provide aren't to your liking. The focal lengths in these tables, by the way, are the marked focal lengths on the lens, not the D80 angle-of-view equivalents.

Diffraction

Diffraction also needs some discussion in regards to the D80's depth of field capabilities. The photosites on the D80 are small enough that diffraction effects now occur at what some would say are mid-range apertures. Nikon hasn't spoken specifically about diffraction on the D80, but says that diffraction begins to appear in images when using apertures physically smaller than f/11 on the D2x. (I concur.) On previous Nikon DSLRs, that break point was more like f/16 or f/22. Thus, you need to balance your depth of field needs (sharpness) with increasing diffraction effects (softness).

For the D80, it appears that f/13 is about the break point where diffraction begins to impact image acuity. I'll caution that this is an anecdotal value I've come up with based upon examination of a lot of images, both on screen and printed. F/13 is the value I currently use on my D80 as my diffraction limited aperture.

I wouldn't rule out using f/16 or f/22 to get an increased depth of field, but be aware that diffraction "steals back" some of the sharpness benefits of the very small apertures. If you're looking for absolute best possible acuity in your images, use f/13 and make sure that the things you want "in focus" are in the depth of field for that aperture and your focus point.

Other DOF Theories

Finally, you should be aware that depth of field is a very contentious subject amongst photographers. Not only are there variants of the circle of confusion formula and methods for using them, but also alternative calculation methods have large followings, as well.

The original Zeiss calculation, for example, was based upon prints smaller than an Epson 1800 or 2400 can produce and which are viewed from distances larger than many of us examine our photos from. I've seen hundreds of interpretations of how to deal with all the variables that come up. When I questioned my mentor about it one day, he showed me that he basically was always using values for one stop faster than the calculations would indicate, "just to be safe."

So instead of using the depth of field charts for f/16, he always used f/11 if he was shooting at f/16. On top of that, he tended to always put whatever depth of field he had at the near focus point in his shot. This was done on the premise that things that are slightly out of focus in the distance aren't generally as obnoxious as things out of focus in the near frame.

Thus, taking two Zeiss-based calculations for his favorite lens where he needed 3' (1m) to be in focus as his near point: instead of using one aperture that said 2.73' to infinity would be in focus, he almost certainly would set his aperture one stop lower and use the value that said 2.55' to 134.44' would be in focus. The way he framed, infinity generally was a smaller portion of the frame than the near point, anyway, so a bit of softness at infinity actually drew your eyes forward to the near interest.

Harold Merklinger's *The Ins and Outs of Focus* (self-published, ISBN 0-9695025-0-8) describes another depth of field method that is based upon the *object field*. Essentially, Merklinger's thesis has you set the lens at infinity focus and then use an aperture that is the physical size of the smallest detail you want to render. For example, with a 50mm lens on the camera, if you wish to resolve details as small as 5mm (regardless of how close they are to you), you'd need to set the lens to approximately f/11. (Please be aware that the preceding is a gross oversimplification of something that takes Merklinger an entire book to describe. Moreover, to my knowledge Merklinger has never taken the consequences of antialiasing into account—his book predates digital.)

D80 Menus

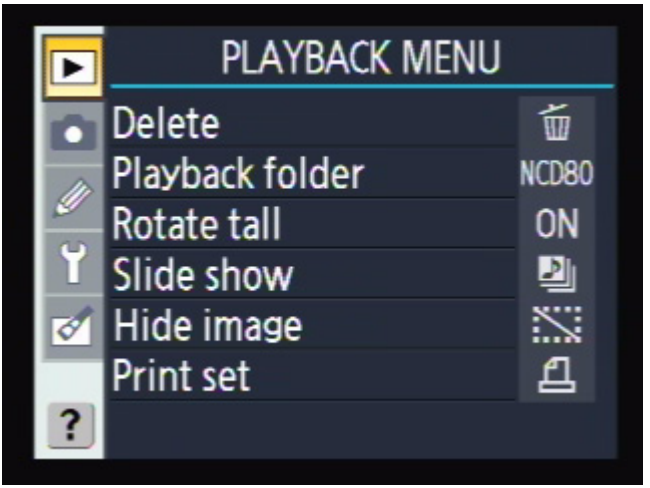
The D80 uses the color LCD extensively to give you clearer indication of your options and settings. Not only are the custom settings on this menu system, but many of the direct digital controls are duplicated with a menu system on the color LCD.

Note: *While you use the Autofocus Direction pad to navigate these menus, some new users can't quite figure out how to move from tab to tab. If you want to move from the* PLAY *tab to the* SHOOTING *tab, for example, you may have to press the ◀ key on the Direction pad to select the tab area, then use the ▲ and ▼ keys to select the tab you desire. Use the ▶ key to then move back to the main portion of that menu, and then use the ▲ and ▼ keys again to move between menu items. That all sounds more complicated than it really is. Short course: if you find you can't get to something, try pressing the ◀ key first.*

Tip: *Keep your eye open for sub-menus that have a* **Done** *option. They're going to trip you up some day, as any of the options for that sub-menu don't get set* until *you've also selected the* **Done** *option. It's kind of like the* **Apply** *button on some Windows dialogs: an annoying extra step that's easy to forget.*

Here's a handy summary of the menu hierarchy (my suggested settings, where appropriate and different from the default, are in green; settings I suggest you try to avoid are in orange):

PLAYBACK menu (▶ tab)



Note: The PLAYBACK *menu and its Menu Items use blue for easy recognition of which menu system you're in (note the blue line).*

Note: The PLAYBACK *menu is disabled and inaccessible if no card is present in the camera.*

Delete
- **Selected**
- **All**

Playback Folder
- **Current**
- **All**

Rotate Tall
- **On**
- **Off** [109]

Slide Show
- **Start**
- **Select pictures**
  - **All pictures**
  - **Select pictures**
- **Change settings**
  - **Style**

[109] Showing images rotated on the LCD makes them too small to assess well, IMHO.

- **Standard**
- **Pictmotion**
- **Frame interval**
  - **2s**
  - **3s**
  - **5s**
  - **10s**
- **Background music**
  - **Pachelbel's Canon**
  - **Scarborough Fair**
  - **Pomp and Circumstance**
  - **Turkish March**
  - **Grandfather's Clock**

Hide Image
- **Select / Set**
- **Deslect All?**

Print Set
- **Select / Set**
- **Deselect All?**

*SHOOTING **menu (📷 camera tab)***

Note: The SHOOTING *menu and its Menu Items use green for easy recognition of which menu system you're in (note the green line).*

Note: The SHOOTING *menu is a scrolling menu, meaning that there are more options available than can be seen at one time. Note the scroll bar on the right side of this menu; the white box shows you where you are in the scrolling Menu Item list. When you move past the bottom of the visible Menu Items, additional Menu Items are revealed.*

Optimize Image
- **Normal**
- **Softer**
- **Vivid**
- **More vivid**
- **Portrait**
- **Custom**
  - **Done**
  - **Image Sharpening**
    - **Auto**
    - **Normal**
    - **Low**
    - **Medium Low**
    - **Medium High**
    - **High**
    - **None**
  - **Tone Compensation**
    - **Auto**
    - **Normal**
    - **Less Contrast**
    - **More Contrast**
    - **Custom**
  - **Color Mode**
    - **I**
    - **II**
    - **III**
  - **Saturation**
    - **Auto**
    - **Normal**
    - **Moderate**
    - **Enhanced**
  - **Hue Adjustment**

Black-and-White
Standard
Custom
Off
Yellow
Orange
Red
Green

Image Quality
NEF (Raw) + JPEG Fine
NEF (Raw) + JPEG Normal
NEF (Raw) + JPEG Basic
NEF (Raw)
JPEG Fine
JPEG Normal
JPEG Basic

Image Size
Large (3872x2592/10.0M)
Medium (2896x1944/5.6M)
Small (1936x1296/2.5M)

White Balance
Auto
Incandescent
Fluorescent
Direct Sunlight
Flash
Cloudy
Shade
Choose Color Temp
Preset

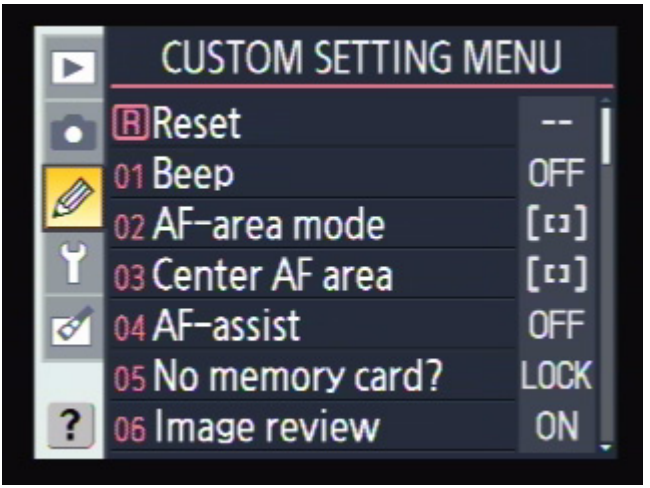
ISO
100 to **1600** in third stop settings (half or full stop with custom setting), plus **H0.3** (2000), **H0.7** (2500), and **H1.0** (3200)

Long exp. NR
Off
On

High ISO NR
On (Normal)
On (Low)

On (High)
Off

*CSM (**custom settings**) menu (✎ **pencil tab**)*



Note: The Custom Setting *menu and its Menu Items use pink for easy recognition of where you are in the menu system (note the line).*

Note: The Custom Setting *menu is a scrolling menu, meaning that there are more options available than can be seen at one time. When you move past the bottom of the visible options, additional options are revealed.*

I'll deal with these individually a little later in the book (see the section starting on page <393>).

SET UP menu (wrench icon)

Note: The SET UP *menu and its Menu Items use orange for easy recognition of where you are in the menu system (note the line).*

Note: The SET UP *menu is a scrolling menu, meaning that there are more Menu Items available than can be seen at one time. When you move past the bottom of the visible Menu Items, additional ones are revealed*[110].

CSM/Setup menu
- **Simple**
- **Full**
- **My menu**

Format memory card
- **No**
- **Yes**

---

[110]If I have any gripe about Nikon's option ordering, it is on this menu. The things that you tend to change once (**World Time** or **LCD brightness**, for example) really should be on the second page and the things you use more often (e.g. **Dust ref photo** or **Battery info**) should be on the first page. In general, Nikon still hasn't glommed on to the frequency with which certain settings are made or consulted, and thus you end up having to press more buttons than you should. The function on this menu you perform most often, for example, is **Format memory card**, which takes an additional two button presses to reach. Fortunately, we have an alternative, more direct method for that function.

World Time
- **Time Zone**
- **Date**
- **Date Format**
- **Daylight Saving Time**
  - **On**
  - **Off**

LCD Brightness
- **-2**
- **-1**
- **0**
- **+1**
- **+2**

Video Mode
- **NTSC**
- **PAL**

Language
- **Deutsch**
- **English**
- **Español**
- **Suomi**
- **Français**
- **Italiano**
- **Nederlands**
- **Polski**
- **Português**
- **Pycckнй**
- **Svenska**
- **Traditional Chinese**
- **Simplified Chinese**
- **Japanese**
- **Korean**

USB
- **Mass storage**
- **PTP**

Image Comment
- **Done**
- **Input Comment**
- **Attach Comment**

Folders

Select folder
New
Rename
Delete
File No. Sequence
Off
On
Reset
Mirror Lock-Up
On
Off
Dust ref photo
Start
Battery Info
Firmware Version
Auto image rotation
On
Off

Retouch menu (Brush tab)

D-lighting
Normal
Moderate
Enhanced
Red-eye correction

Trim
- **2560x1920**
- **1920x1440**
- **1280x960**
- **960x720**
- **640x480**

Monochrome
- **Black-and-white**
- **Sepia**
- **Cyanotype**

Filter effects
- **Sky light**
- **Warm filter**
- **Color balance**

Small picture
- **Select picture**
- **Choose size**
  - **640x480**
  - **320x240**
  - **160x120**

Image overlay

My Menu Option (Create your own menus)

The D80 has a lot of menu items, which can cause a lot of button pressing. It would be very frustrating if you had to press a dozen buttons simply to cancel the last thing you set on the camera.

Fortunately, Nikon came up with a solution for that: the **My menu** option. This option allows you to select which menu items appear on each of the individual menus.

Here's my take:

- You don't have to change the PLAYBACK menu at all. Since it's a single page of six options, removing something from the PLAYBACK menu is really only a benefit if you always use something lower on the list and never use something higher on the list.

- The SHOOTING menu is also not a likely place you'll want to remove items, as this menu mostly contains critical settings that you can and do change often.
- The Custom Settings menu is one place where simplification is useful. Quite a few of the options here are things you tend to set and leave, while others you use more often. My candidates for removal are: 1, 5, 9, 10, 11, 12, 14, 15, 17, 19, 20, 21, 27, and 28. But don't remove them before you set them to the value you want your camera to use!
- The SET UP menu is another place where you might want to simplify. First, however, make sure to set **CSM/Setup menu** to **Full**. Next, make your one-time settings. Finally, use the **My menu** option to remove: **Video mode**, **Language**, and **Image comment**.
- The RETOUCH menu is like the PLAYBACK menu: it only presents one screen of primary options, so the only reason to remove something you don't use is to move one of the lower options up so that you press fewer buttons to access it.

Error Messages

The D80 viewfinder and top LCD have a number of indicators that remind you how the camera is set while you're shooting. But more important is that these displays show error messages you need to be aware of:

Message	*Where Seen*	*What it Means*
FEE (blinks)	Viewfinder, top LCD	The lens has not been set to the smallest aperture. ***Solution****:* Set the aperture ring on the lens to the smallest aperture (usually f/22).
• (blinks)	Viewfinder	Camera cannot obtain autofocus (normally only seen in dim light or low contrast situations, but also seen sometimes with lenses whose maximum aperture is near f/8). ***Solution****:* Focus the lens manually. Or use the Autofocus Assist lamp on your flash.

Message	*Where Seen*	*What it Means*
H I	Viewfinder, top LCD	Camera may not set proper exposure and the resulting ambient lighting will be overexposed. ***Solution****:* Choose a lower ISO value, if possible. In Program exposure mode, use a neutral density filter, a polarizer, or choose another exposure mode; in other exposure modes, choose smaller apertures or shorter shutter speeds.
Lo	Viewfinder, top LCD	Camera may not set proper exposure and the resulting ambient lighting will be underexposed. ***Solution****:* Choose a higher ISO value, if possible. In Program exposure mode, use flash or choose another exposure mode; in other exposure modes, choose larger apertures or longer shutter speeds, or use flash.
bulb (blinks)	Viewfinder, top LCD	The camera is indicating that you've set the shutter speed to bulb and then switched to Shutter-priority mode. ***Solution:*** If you want to use a bULb shutter speed, switch to Manual exposure mode; otherwise set a valid shutter speed (the camera can't set an aperture when it doesn't know how long the shutter will be open).

Message	*Where Seen*	*What it Means*
0 (blinks) card icon may blink if overlays are active	Viewfinder, Top LCD (Cd blinks)	The card is full of images. ***Solution****:* Remove the current storage card and replace with a blank one, or transfer the images to computer via USB and format the storage card. If all you need is a couple more shots, try deleting images you don't need or setting an **Image quality** and **Image size** that uses less storage space. *Note: This isn't the 0 in the analog exposure display blinking (which indicates that exposure compensation is set). This is the 0 in the Frames Remaining indicator.*
◀ -|...|0|...|+ ▶ (blinks)	Viewfinder	The scene brightness exceeds that which the meter can handle. ***Solution****:* Use a neutral density filter in bright situations, flash in dim situations.
Shutter speed (blinks)	Top LCD	You're trying to use flash at a shutter speed higher than the sync speed; the camera will set 1/200. ***Solution****:* The camera automatically sets the shutter speed to 1/200 (which shows as the shutter speed in the viewfinder).

Message	*Where Seen*	*What it Means*
ϟ (blinks)	Viewfinder	After exposure: flash fired at full power and the resulting image may be underexposed (it may also be correct). ***Solution****:* Review the image on the color LCD. If it is underexposed, use a larger aperture or reduce subject distance.
Err (blinks)	Viewfinder and top LCD	A camera malfunction has occurred. ***Solution****:* Press the shutter release again. If the problem persists, take the camera in for servicing. (Also consider performing the steps mentioned in "The Last Resort Reset" on page <200>.
👁(blinks)	Top LCD	Speedlight doesn't support red eye reduction. ***Solution****:* Cancel red-eye reduction Flash Option on the camera.
(blinks)	Top LCD; ϟ blinks in viewfinder	Speedlight doesn't support i-TTL. ***Solution****:* Either switch the flash to Automatic or Manual flash mode, or substitute an i-TTL capable flash.
• (stays on)	Back of camera Card Write indicator lamp	An image (or images) in the buffer has not yet been completely written to the card. Check to make sure you haven't taken a long exposure with **Long exp. NR** turned **On**—the Write indicator lamp will stay lit while the "dark frame" is being taken, which

		takes at least half the time of the actual exposure. Also happens when you've taken a large number of photos and a full buffer needs to be written to the card. Sometimes due to card write errors, this lamp stays lit. You may lose the most recently taken image(s) if you do this, but remove power from the camera and try another card.

Some error messages appear only on the top and color LCD:

Message	*Where Seen*	*What it Means*
-E- **NO CARD PRESENT**	Top LCD color LCD	The camera can't detect a Secure Digital card in the slot. ***Solution****:* Check to make sure that you've inserted a card and that it is properly engaged in the slot.
CHA (blinks) **THIS CARD CANNOT BE USED**	Top LCD color LCD	The camera is having trouble accessing the Secure Digital card. This may indicate that the card is not formatted correctly or already contains the maximum number of files. ***Solution****:* Use a different card, or, if the card you inserted wasn't formatted properly, try to format it again.
For **CARD IS NOT FORMATTED**	Top LCD color LCD	The Secure Digital card you inserted hasn't been formatted for use in the camera. ***Solution****:* Format the card. *Note*: the For message also appears *during* formatting operation.

Message	*Where Seen*	*What it Means*
FOLDER CONTAINS NO IMAGES	color LCD	You're attempting to play back images from a folder on a card that contains none. ***Solution**:* It's possible that images are on the card, but in a different folder, so check to make sure that you've selected the proper folder. Otherwise, take a picture!
ALL IMAGES HIDDEN	color LCD	You're attempting to play back images from a folder on a card where all the images have been hidden. ***Solution**:* Unhide at least one image in the current playback folder; alternatively, select all folders for playback.
FILE DOES NOT CONTAIN IMAGE DATA	color LCD	Usually appears when you've overwritten a file using a computer. ***Solution**:* try looking at the image on a computer.
K	Top LCD	Not really an error. The camera is simply indicating that the Secure Digital card has space for more than 1000 exposures at the current settings.
r00 to r09	Viewfinder	Not really an error, though many who don't read the manual carefully think it is. What the camera is trying to tell you is how many shots remain in the buffer[111].

[111] You'll note that the camera never displays a number higher than 9 for the buffer. But in Continuous frame advance mode at 3 fps, you'll also note that the indicator doesn't count down for each image. How fast the indicator counts down and the effective size of the buffer is determined by how fast your Secure Digital card is.

Image Review and Playback

The D80 allows images to be reviewed quickly and conveniently, and provides several options for viewing them. We'll deal with things that pertain to reviewing and marking images in this section.

Image Review

Quick review is accomplished by pressing the ▶ button on the back of the camera to turn the color LCD ON. After a brief delay, the most recently taken or displayed image is shown on the color LCD. The camera normally shows:

- The most recently *displayed* image if you have used the color LCD since taking a picture.
- The most recently *taken* picture if you've taken a picture since you last reviewed one.

(Yes, describing this difference is more difficult than it works out to be in practice.)

Note: The "normally shows" I just mentioned applies to the camera's default behavior. It's possible that you last left the camera showing multiple thumbnails, and if that is the case, you'll be shown the thumbnail view again when the camera displays the most recently taken image in playback. Press the Zoom In button (🔍) until you see only one image again.

If no images have yet been stored on the Secure Digital card into the current folder, a message **FOLDER CONTAINS NO IMAGES** is displayed instead of an image:

If you see this message, try navigating to the **Playback folder** option on the PLAYBACK menu and make sure that you're pointing to the correct folder (or select all folders for playback).

When you're done with a quick review, press the ▶ button again to turn the color LCD OFF, or press the shutter release partway as if you're taking a picture.

Note: The color LCD has a default power-off time (set via Custom Setting #27, see "Color LCD Active Time" on page <437>). Press the ▶ button to turn the color LCD back ON. If this is done after the camera's meter-off time has expired, the color LCD displays the same thing it did when it shut OFF; if the meter-off time has expired, the color LCD displays the most recent image in memory when it comes ON.

The image automatically appears for review on the color LCD after you take a picture if you set the image review option in Custom Setting #6 to **On**. Remember that you can also always press the ▶ button to see the image.

Image Review Options

Whenever an image is shown on the color LCD, you have a number of options you can use:

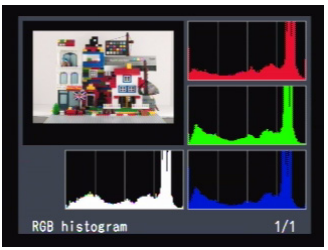
- You can browse through any other pictures on the Secure Digital card by using the ◀ and ▶ keys on the direction pad (when you get to the last picture, the camera loops back to the first, and vice versa). You can also use the Rear Command dial to move through the pictures.
- You can browse through information pages for the current image by using the ▲ and ▼ keys on the direction pad (when you get to the last information page, the camera loops back to the first, and vice versa). You can also use the Front Command dial to move through the page options.

Some other Nikon bodies use the opposite orientation, but on those cameras you can usually use a Custom Setting to make the directions match those of the D80 (and the other low-end

Nikon DSLR bodies). Thus, if you use a D80 as a backup body to a D200 or D2xs, you might want to make sure that you've set the browsing directions the same on your D200 or D2xs.

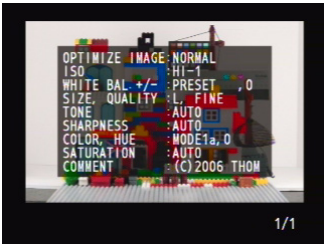
The pages, in order, are:

Page 1: folder and filename, size and image quality, frame count (#/# in upper right corner; first number is current frame number, second is the total number of frames in current folder), date and time.

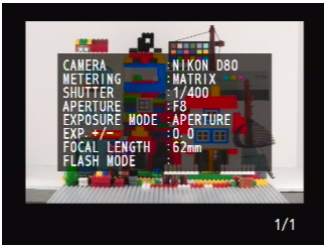


Page 2: RGB Histogram—the frame count appears in the lower right corner. Luminance (white) appears below the image and individual channel histograms (red, green, and blue) appear to the right.

Page 3: overexposed highlights blink—the frame count appears in the lower right corner (**1/1** in this example).



Page 4: Image optimization, ISO, white balance, white balance adjustment, size and quality, tone, sharpness, color mode plus hue setting, saturation setting, and image comment appear. The frame count appears in the lower right corner.



Page 5: Camera, metering method, shutter speed, aperture, exposure mode, exposure compensation, focal length, and flash mode are shown. The frame count appears in the lower right corner.

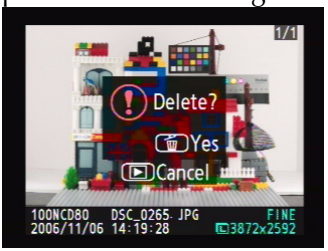
You can protect the currently viewed image from deletion (but not from a card format) by pressing the 🔑 button while the image is being displayed. A 🔑 icon appears at the left top of the image:

Note that protected files are marked with a read-only marker that persists when you move them to a computer.

Tip: *In Windows, select the read-only file in a Windows Explorer window. Next select* **PROPERTIES** *from the* **FILE** *menu. Uncheck the box labeled* **Read-only** *to remove the read-only attribute.*

On a Macintosh using OS 9.x or OS X, select the read-only file and press **Apple - I** *(that's an i) to see the General Information box for the file. Uncheck the box labeled* **Locked** *to remove the read-only attribute.*

- You can delete the currently viewed image by pressing the 🗑 button. You'll be prompted to confirm the deletion: press the 🗑 button again to do so.

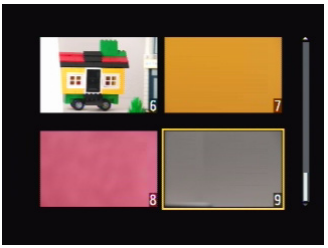


If the image was protected, you'll see **File Protected** when you press the Delete button.

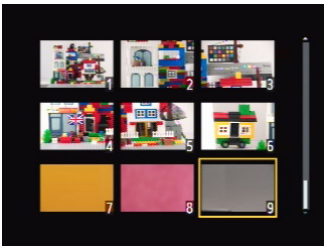
Unprotect the image before trying to delete it (press the 🔑 button).

- You can display thumbnails of multiple pictures by pressing the Zoom Out (🔍) button. Each press of this button moves you one step further "away" from your images, which allows you to select 1 image per screen, 4

images per screen, or 9 images per screen when thumbnails are shown. Note that whatever choice you make is remembered, and that if more than one thumbnail is displayed, you can no longer reach other information pages about an image (the keys on the direction pad control moving between thumbnails when multiple images are displayed; the currently selected image is outlined in yellow).



4 images per screen



9 images per screen

- You can magnify the view by pressing the "Zoom In" button (🔍). Each press takes you "closer" to the image.

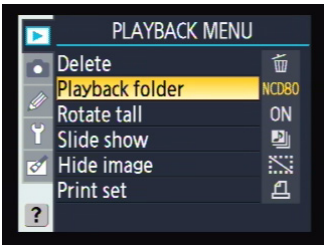
The box in the lower right corner is a navigation box and appears briefly at each zoom level. You can use the Direction pad keys to navigate to other areas of the image using the same zoom factor.

To move back away from the image, press the Zoom Out button (🔍). Each press takes you further away from the image.

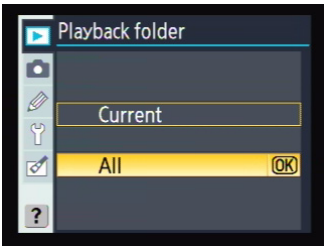
Image reviewing has a different timeout setting than the shooting mode of the camera (the default is 20 seconds; see "Custom Setting #27, Color LCD Active Time" on page <437>). If you have Custom Setting #6 turned on, images are automatically displayed after being taken, but only for four seconds.

Don't panic if you see the **FOLDER CONTAINS NO IMAGES** message. The camera is trying to tell you that it can find no images in the *current folder* of the card; that doesn't mean that there aren't images on the card. Whenever you see the **NO IMAGES** message and you know that there are images on the card:

1. Press the **MENU** key to show the menu system.
2. Use the Direction pad to navigate to the PLAYBACK menu.
3. Use the Direction pad to navigate to **Playback folder** and press the ▸ key on the Direction pad or the **OK** button to select it.



4. Use the Direction pad to select **All** and press the ▸ key or the **OK** button one more time to complete the action.

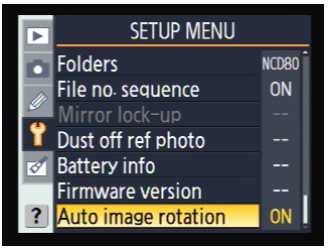


Rotating Images

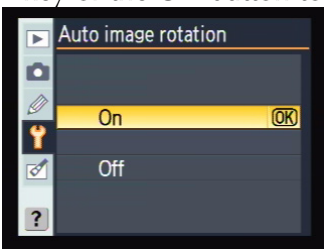
Images are usually displayed on the color LCD with the long axis across the long axis (i.e., vertical images aren't displayed rotated). The D80 has an automatic rotation detector, however. You can activate this so that images are correctly rotated to the proper orientation by Nikon PictureProject and Nikon Capture NX.

To turn on automatic image rotation:

1. Press the **MENU** key to show the menu system.
2. Use the Direction pad to navigate to the SET UP menu (wrench icon tab).
3. Use the Direction pad to navigate to **Auto image rotation** and press the ▸ key on the Direction or the **OK** button to select it.



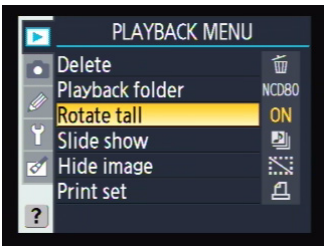
4. Use the Direction pad to navigate to **On** and press the ▸ key or the **OK** button to complete the setting.



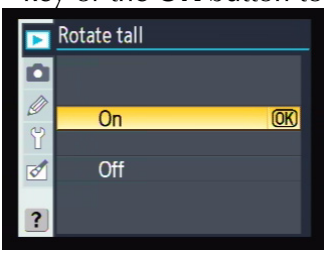
If you've set **Auto image rotation** to **On**, Nikon PictureProject and Nikon Capture NX also automatically rotate the images during transfer to your computer so that they'll show up in the correct orientation in whatever software you use. Other software may or may not recognize the rotation information in the file.

However, even if **Auto image rotation** is set to **On**, that doesn't mean the images show up rotated on the color LCD on the camera. For that you have to make a change in the PLAYBACK menu settings:

1. Press the **MENU** key to show the menu system.
2. Use the Direction pad to navigate to the PLAYBACK menu (wrench icon tab).
3. Use the Direction pad to navigate to **Rotate tall** and press the ▸ key on the Direction or the **OK** button to select it.



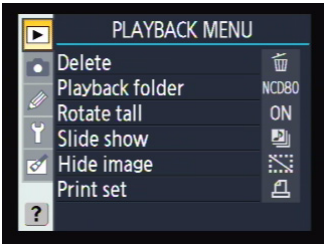
4. Use the Direction pad to navigate to **On** and press the ▸ key or the **OK** button to complete the setting.



Personally, I don't like the **Rotate tall** option, as it starts to make the review image too small to quickly evaluate. I leave this option **Off** on my D80 and just tilt the camera or my head.

The PLAYBACK Menu

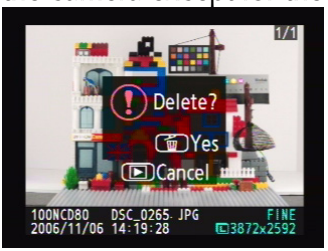
Pressing the MENU button and selecting the first tab (▶) displays a selection of Menu Items on the color LCD:



The ▲ or ▼ keys on the Direction pad are used to navigate between the Menu Items (the currently selected item is highlighted; sometimes that's the tab, as in this case), and you press the ▶ key on the Direction pad or the **OK** button to select the highlighted Menu Item. Note that some of the Menu Items can be performed directly on the currently shown (or selected) image without using the menu system (e.g. **Delete** using the 🗑 button). The following sections detail each of the various PLAYBACK menu options.

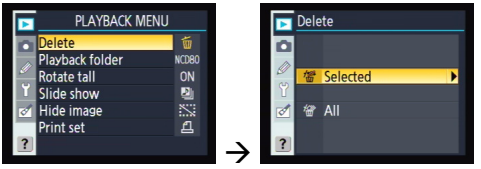
Deleting Images

📷 You can delete the image that is shown on the color LCD (or the currently selected thumbnails) by pressing the 🗑 button on the back of the camera. Before actual deletion begins, you'll be asked for confirmation, which you indicate by pressing the 🗑 button again (press any button on the back of the camera except for the 🗑 button to cancel deletion).

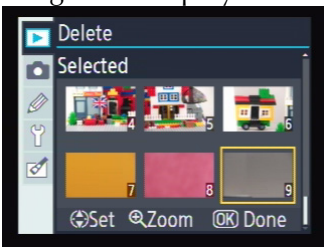


📷 Alternatively, you can use the **Delete** option on the PLAYBACK menu, which can delete either a few images or all of them:

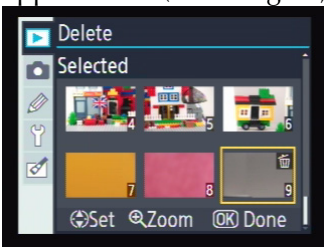
1. PLAYBACK -> **Delete** -> **Selected**



2. Images are displayed six at a time:

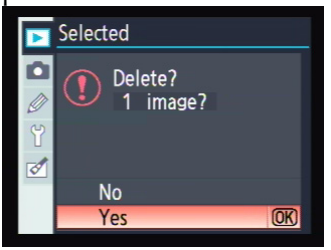


3. The ▲ and ▼ keys on the Direction pad select or deselect image(s) for deletion (you'll see the 🗑 icon appear on it (see image 9, below).



4. The **OK** button is used to tell the camera you wish to delete the selected images.

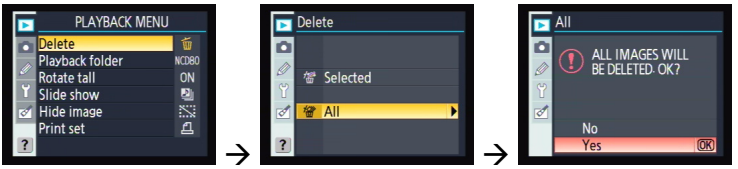
5. Navigate to **Yes** and press the ▶ key on the Direction pad or the **OK** button to complete the action.



Here are the two **Delete** options via the menu system:

Selected

As just outlined in the screen shots, above, the D80 displays a thumbnail view of the images, six at a time (Step 2, above). You navigate through them similarly [112] to the way you would in thumbnail view (◀ and ▶ key on the Direction pad), pressing the center position on the Direction pad on each image you want to erase (each press is a toggle, and a small trash can appears on any image scheduled for deletion—Step 3, above). You can also press the Zoom In button (🔍) to temporarily see a larger version of the currently selected image (useful when you have a sequence of very similar images and are trying to erase just one). You confirm the deletion of all the selected images by pressing the **OK** button, navigating to **Yes**, and pressing the **OK** button again when prompted (Steps 4 and 5, above). Images marked with a protect symbol cannot be deleted; hidden images aren't displayed.



All The D80 immediately displays a confirmation prompt. Navigating to **Yes** and confirming that by pressing the **OK** button immediately deletes all photographs on the card *except for ones that have been marked as* **PROTECTED** *or are* **HIDDEN**.

[112] It's actually these small differences that make the D80 and D200 enough different to be troublesome. The D200 Direction pad can be pressed in the middle, and this action is used to "mark" things, as you need to with this function. That means that *all* the Direction pad keys can be used to navigate on thumbnail displays. On the D80, only the ◀ and ▶ keys can navigate, because you're using the other keys to mark the images. Again, a small difference, but one that will slow down a D200 user unless they've standardized on always using the D80 navigation keys (i.e. a subset of what they *can* use).

Nikon's manual says that deleted images cannot be recovered. They can, but not easily, and only if you take immediate action. If you accidentally erase an image (or more) on a card, set that card aside until you can access it with your computer. Use an image recover utility program such as PhotoRescue (http://www.datarescue.com/photorescue/) to recover the deleted file before doing anything else with the card. This works because the act of deletion doesn't actually remove the data for an image, it simply marks the space used by the file as available. Thus, if you write additional images to a card after deleting a file, you often can't recover the deleted file, as the D80 has probably used the space for the new images.

Dealing with Folders

I've dealt with it earlier, but it's worth repeating here as we go through the PLAYBACK menu options: the D80 uses folders to organize images stored on the Secure Digital card. Because the D80 follows the DCF digital camera standard (Design Rule for Camera File Systems) agreed to by most manufacturers, there are limitations on folder names and locations.

If you do nothing (i.e. don't use any of the options on the **Playback Folder** selection on the PLAYBACK menu, the D80 creates a root folder named DCIM, which in turn contains a folder named 100NDC80. The first 999 images stored on the card are stored in that folder, then a new folder named 101NDC80 is created and the next 999 images stored there [113]. This process of creating new folders every 999 images continues until you fill the card. Thus, when you examine the structure of the Secure Digital card on your computer, you may see something like this:

[113] If you reformat the card or otherwise erase the images in a folder before the image count gets to 999 for that folder, no new folder is created. In other words, it's not that a new folder is always created every time you take 999 images; it's that a new folder is created when the current folder *contains* 999 images.

```
DCIM
 +----100NDC80
 +----101NDC80
    etc.
```

You can create new folders, but they always have a number as the first three characters and the D80 identifier as the last five (e.g. **102NDC80**), which isn't particularly flexible.

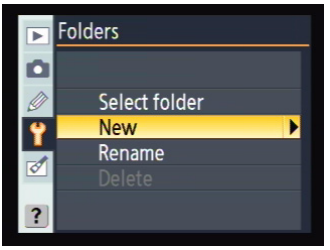
Once again, here's the full extent of what you can do with folders on a D80:

Create a new folder:

1. Press the **MENU** button to see the menus on the LCD.
2. Use the Direction pad to navigate to SETUP menu (camera icon tab).
3. Use the Direction pad to navigate to **Folders** and press the ▸ key on the Direction pad or the **OK** button to select it.

4. Use the Direction pad to navigate to **New** and press the ▸ key on the Direction pad or the **OK** button to

select it.



5. In the display that appears:

   a. Use the keys on the Direction pad to navigate to a letter.

   b. Press the Zoom In button (🔍) to enter that letter.

   c. Hold down the Zoom Out button (🔍▦) and use the Direction pad to navigate to a different letter position, if desired.

   d. Press the Delete button (🗑) to delete an entered letter.

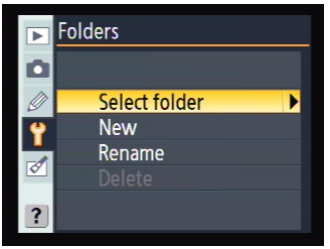
   e. Press the **OK** button to complete entry of your new folder name.

📷 Select which folder the camera writes to:

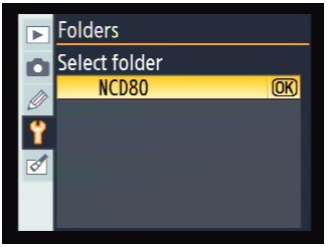
1. Press the **MENU** button to see the menus on the LCD.
2. Use the Direction pad to navigate to SETUP menu.
3. Use the Direction pad to navigate to **Folders** and press the ▶ key on the Direction pad or the **OK** button

to select it.

4. Use the Direction pad to navigate to **Select Folder** and press the ▸ key on the Direction pad or the **OK** button to select it.



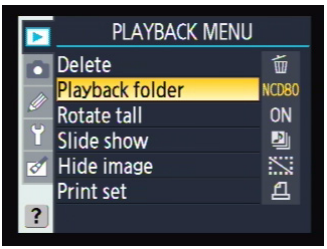
5. Navigate to the folder name you wish to use and press the ▸ key on the Direction pad or the **OK** button to select it.



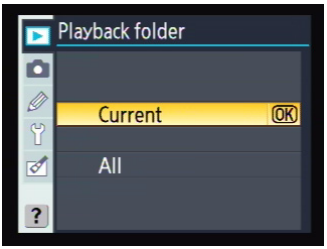
Select which folders to display in playback:

1. Press the **MENU** button to see the menus on the LCD.
2. Use the Direction pad to navigate to PLAYBACK menu.
3. Use the Direction pad to navigate to **Playback Folder** and press the ▸ key on the Direction pad or the

OK button to select it.

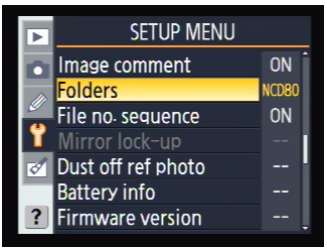


4. Use the Direction pad to navigate to the folder name you wish to use and press the ▸ key on the Direction pad or the **OK** button to select it. (Alternatively, you can also choose **All** or **Current**.)



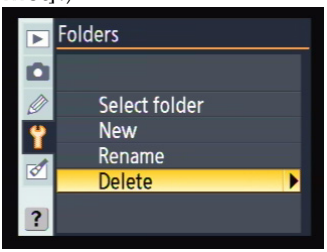
The D80 allows you to delete *empty* folders:

1. Press the **MENU** button to see the menus on the LCD.
2. Use the Direction pad to navigate to SETUP menu.
3. Use the Direction pad to navigate to **Folders** and press the ▸ key on the Direction pad or the **OK** button to select it.

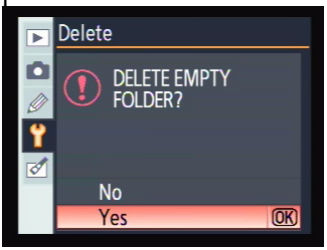


4. Use the Direction pad to navigate to **Delete** and press the ▸ key on the Direction pad or the **OK** button to select it. (If this Menu Item doesn't appear, then you haven't created any new folder names to delete or you have images stored in the current folder; you can't

delete the default folder name, and you can't delete a folder that has images in it[114] [hint: delete the images first].)



5. Navigate to **Yes** and press the ▸ key on the Direction pad or the **OK** button to select it.



Folder *numbers* are a different story. They can't be easily reset on the D80.

Folders are seriously confusing and restraining on the D80, at least if you start doing things that create new ones. I strongly advise against creating additional folders on the D80 (note that if you shoot more than 999 images on a card, you might have one created automatically by the camera). Not only will it create confusion when transferring images to your computer, but unless you're disciplined about erasing folders and restoring your "active folder" (**Folders→Select folder**) setting, you'll start folder creep, which can be annoying.

Hiding Images

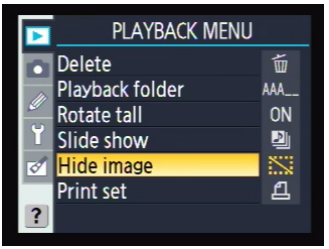
The D80 allows you to "hide" images, which prevents them from displaying in PLAYBACK mode or in slide shows. When

[114] Nikon *could* first display a warning message saying "Warning: the folder you've selected to delete contains images, are you really sure you want to delete it?" But apparently they prefer to make it more difficult to delete folders with images than it has to be.

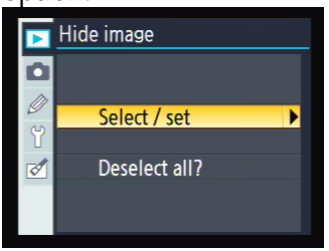
copied to a computer, hidden images are marked with both the hidden and read-only attributes, meaning that they don't normally display in directories.

To hide images:

1. Press the **MENU** button to see the menus on the color LCD.
2. Use the Direction pad to navigate to the PLAYBACK menu.
3. Use the Direction pad to navigate to **Hide image** and use the ▸ key on the Direction pad or the **OK** button to select it.

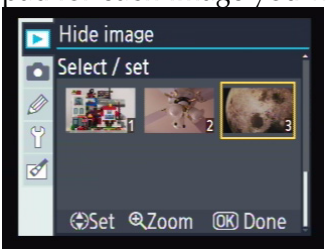


4. Choose whether you want to hide/unhide individual images (**Select/set**) or unhide all previously hidden ones (**Deselect all**) by navigating to the appropriate option with the Direction pad and pressing the ▸ key on the Direction pad or the **OK** button to select your option.

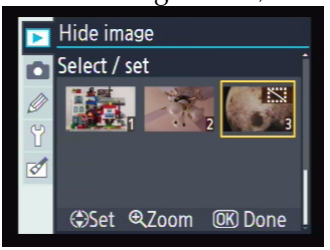


5. For **Select/set** the D80 displays a thumbnail view of the images, six at a time. Navigate through them exactly as you would in thumbnail view (using the ◂ and ▸ key), pressing the ▴ or ▾ key on the Direction

pad for each image you want to hide.



6. Confirm the hide action by pressing the **OK** button. Hidden images get a ⊠ icon on them (e.g. image 3 in the following screen):



Tip: *On a Macintosh using OS 9.x, you'll need a utility such as ResEdit in order to make a file visible again. In ResEdit, select* **Get File/Folder Info…** *from the* **File** *menu. Uncheck both the* **File Locked** *and* **Invisible** *boxes to remove the hidden attribute. In OS-X you get to the* **Locked** *file attribute by using* **Get Info** *(Apple-I) on the file (it's in the* **General** *section, which is usually opened by default; click on the ▸ next to it if it isn't).*

The easiest way to restore hidden images is to use the **Deselect All?** option on the **Hide image** menu (see Step #4, above).

Other PLAYBACK Menu Options

Are described elsewhere:

- **Rotate tall**: "Rotating Images" on page <380>
- **Slide show**: "Slide shows" on page <593>
- **Print set**: "Selecting Images to Print" on page <580>

Custom Settings

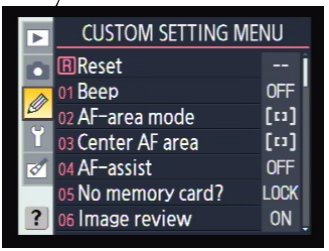
The good news is that many of the camera's defaults can be overridden or modified. The bad news is that Nikon's method of making these changes is slightly cumbersome.

Having to scroll through 33 Custom Settings choices can be time-consuming, especially for those of us who use multiple Nikon bodies. Why? Because Nikon keeps changing the Custom Settings number for functions that are identical across the bodies. For example, the self-timer function is #16 on the F100, F5 and D1s, but it is labeled #C4 on the D2 series and D200, and #29 on the D80.

Yes, with 32 possible settings, setting up your camera could take you a while to do. Another option is to use Nikon Camera Control Pro to make the settings with your camera connected to your computer. This is the way I usually do it, as it goes a little faster than making lots of changes on the camera.

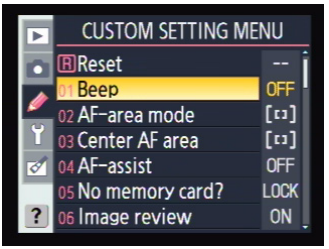
All custom settings are made by:

1. Pressing the **MENU** button to bring up the menus on the color LCD.
2. Using the Direction pad to navigate to the CUSTOM SETTING menu (the purple pencil icon) and press the ▸ key or the **OK** button to select it.



3. Using the Direction pad to navigate to an option and press the ▸ key or the **OK** button to begin making your

selections.



Note: Unlike many other Nikon DSLR bodies, no asterisk appears in front of Custom Setting number on the D80 menu system to indicate that you've changed that item from a default setting. Therefore, you must pay careful attention to the actual settings on the right.

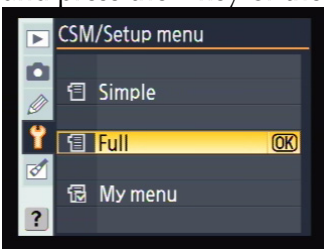
Unfortunately, not all Custom Settings appear when you first use the D80. You need to first tell the camera that you want them all to appear; otherwise you'll only see the first 10 options:

1. Press the **MENU** button to bring up the menus on the color LCD.
2. Use the Direction pad to navigate to the SETUP menu (the wrench icon) and press the ▸ key or the **OK** button to select it.

3. Use the Direction pad to navigate to the **CSM/Setup menu** option and press the ▸ key or the **OK** button to

select it.

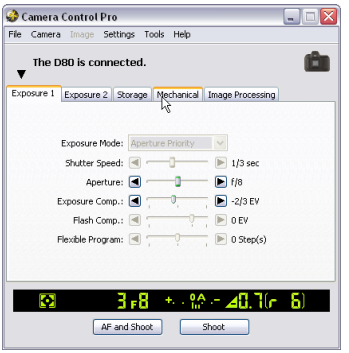
4. Use the Direction pad to navigate to the **Full** option and press the ▸ key or the **OK** button to select it.



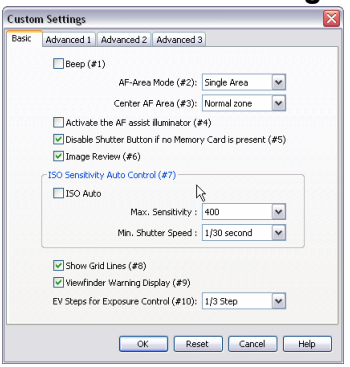
You may think that setting a lot of Custom Settings is going to be a big pain. Not really. As I noted earlier, I use my computer. With your D80 connected to the computer, here's how you use Nikon Camera Control Pro:

1. Connect your D80 to your computer via a USB cable (and make sure that you've set the **USB** setting to **PTP**.

2. Start Nikon Camera Control Pro. You'll see the basic connection screen:



3. Choose **Custom Settings** from the **Camera** menu.



4. For each option you wish to set:
    i. Navigate to each option you wish to set. The first 10 Custom Settings are on the first (**Basic**) tab. Additional settings are on the other tabs (for example, flash settings are on the **Advanced 2** tab). Make sure you visit all the tabs.
    ii. Select your setting for each option.
5. Click the **OK** button to complete creation and transfer of your Custom Settings.

There are 32 individual Custom Settings (plus the **Reset** option), and the values and terminology used for each are sometimes obvious, sometimes cryptic, so follow along closely. I'll provide a complete description of each option, along with my recommendations for each.

Note: In the sections that follow, my name for the custom setting is given in the title. The name displayed underneath it is the one the D80 menu system shows.

Custom Setting #R Custom Settings Reset

(Reset Custom Setting Menu)

The D80 has a simple method of canceling all user-set Custom Settings in *the current bank* and returning them to the defaults:

No No change to Custom Settings (no reset)

Yes Reset the Custom Settings to the default values

When you select **Yes**, the default values are restored for all custom settings. See the following table for the defaults (and my quick and dirty recommendations).

Setting	*Default*	*Recommendation*
1: Beep	On	On for AF novices, otherwise Off
2: AF Area Mode	Auto-area	Single or Dynamic area depending upon situation
3: Center AF area	Normal zone	Wide zone for some types of photography
4: AF-assist	On	Off
5: No Memory Card	Release locked	Release locked
6: Image Review	On	On
7: ISO Auto	Off	On, Max 400, Min Shutter Speed 1/15
8: Grid Display	Off	On
9: Viewfinder warning	On	On
10: EV Step	1/3 stop	1/3 stop
11: Exposure Comp	Off	Off
12: Center-weighted	8mm	Generally 8mm, but 6mm if you're coming from a camera that has a tighter center-weight circle
13: Auto BKT Set	AE & flash	AE only
14: Auto BKT Order	Default order	Under>MTR>over
15: Command Dials	Default	Default

Setting	*Default*	*Recommendation*
16: FUNC button	ISO display	AF-area mode, FV lock, or spot metering depending upon your priority; ISO if Auto ISO is On
17: Illumination	Off	Off
18: AE-L/AF-L	AE/AF lock	AE lock, AE lock hold, or FV lock depending upon your priority
19: AE Lock	Off	Off
20: Focus Area	No wrap	Wrap
21: AF Area Illumination	Auto	Auto
22: Built-in Flash	TTL	TTL
23: Flash warning	On	On
24: Flash shutter speed	1/60	1/15
25: Auto FP	Off	On
26: Modeling Flash	Off	On
27: Monitor-Off	20s	20s
28: Auto Meter Off	6s	8s
29: Self-Timer	10s	2s
30: Remote On Duration	1min	5min
31: Exp. Delay Mode	Off	On when needed (telephoto, macro at <1/30 second on tripod)
32: MB-D80 Batteries	Default	Whatever you're using!

Recommendation:

1. Use this setting carefully. As I noted earlier, there's no quick and easy way to reload your Custom Settings except while connected to a computer using Nikon Camera Control Pro.

Custom Setting #1 Sound Feedback Setting

(Beep)

The D80 has the usual Nikon consumer body beeping sound capability; it's the default setting. This can be altered:

On Camera beeps during countdowns and focusing [default]

Off Camera emits no beeps

Recommendation:

1. If you're new to DSLRs, the beep sound is useful in that it tells you when the AF system has acquired focus (i.e. you can't take a picture in Single Servo AF until you hear the beep). Otherwise, I find it annoying and recommend you turn it off once you've gotten familiar with how and the speed at which the AF system works.

Custom Setting #2 Autofocus Area Mode Setting

(AF-area mode)

This setting was discussed earlier in the autofocus section (the full description of the difference is in "Autofocus Area Modes" on page <327>):

Single area Only a single area is used [default]

Dynamic area Area follows subject

Auto-area AF Closest area with focus is used

The top LCD shows an icon to tell you what you've set:

Single area

Dynamic area

Auto Area (basically Closest Subject Priority)

Recommendations:

1. Again, this is a conditional setting, though with more twists than Focus mode (see page <324>). If you've never used a sophisticated autofocus system before, it is probably safest to leave the camera set to the default, which will vary the camera's technique based upon the exposure mode you've selected:

AF Area Mode	*Exposure Modes*
Single area	Program, Shutter-priority, Aperture-priority, Manual, Close-up
Dynamic area	Sports
Auto-area AF	Auto, Portrait, Landscape, Night Landscape, and Night Portrait

2. Consider **Single area** when you're dealing with non-moving subjects, especially ones that are off-center.
3. Consider **Dynamic area** when you're shooting fast moving action, especially if that action may be moving across the frame. If you do use this setting, pay careful attention to the starting sensor used (e.g., if action is going from top to bottom of the frame, you probably should start autofocus from the top sensor). Avoid spot metering with this setting unless you've paid particular attention to what

I wrote in the metering section. You may not be metering where you think you are.

4. Photographers either love or hate **Auto-area AF**. On the positive side, it tends to work like magic when it works. I remember one photo I took of my two-year old god-daughter and her parents walking where she had run just a bit ahead of them, and the camera correctly focused on her despite the fact I had my autofocus sensor trained on her dad (the Nikon body I was using allowed me to pick a sensor but overrode my selection). Magic. But this setting has a host of caveats and interactions (spot metering only in the central sensor, for example), and it sometimes does the absolutely wrong thing. For example, at crowded parties, a typical bad response is that the camera might focus on the shoulder of someone who cut in front of you and is passing just out of the frame when you wanted it to focus on the couple a few feet further on.

Custom Setting #3 Focus Area Size

(Center AF area)

Unique to the D80 is the ability to set the framing area (size of the detection area) of the central autofocus sensor. As I noted several times earlier in this work, the underlying part that contains the autofocus sensors actually has seven physical sensing areas to it. The central area can be set to look at a wider area or a narrower area.

Normal zone Narrow sensing area used [default]

Wide zone Wider sensing area used

Recommendations:

1. One important thing to notice is how the camera displays the AF sensing area. In **Wide zone**, the central AF sensor is shown as distinctly wider, and it is. But what does that mean? Well, in **Wide zone** there's a bit of Closest Subject Priority going on. The wider sensor area is big enough so that it is often on both a near and far subject simultaneously. In that instance, the closest subject under the widest version of the sensor appears to be used. For example, if the left-hand portion of the center sensor is on something at 10 feet and the right-hand portion of the center sensor is on something at 20 feet, the camera focuses at 10 feet. In **Normal zone**, the central sensing area is small enough that it normally only obtains focus on one thing (you'd need a really wide lens and lots of tight detail at different distances for it to react the same way as **Wide zone**, something that just doesn't occur in nature).
2. This is a subject-motivated setting. For example, while shooting flying birds, I actually preferred **Wide zone**, because the wider sensing area almost always got enough of the bird to get the right focus, while **Normal zone** sometimes was small enough to sometimes miss part of the centered bird. Ditto for many sports. In general, I tend to use the **Wide zone** option when I have rapidly moving objects that intersect the central area of the frame.

Custom Setting #4 Autofocus Assist Illumination

(AF-Assist)

The D80's Autofocus Assist lamp is controlled by this function:

On	In poor lighting, the Autofocus Assist light on the camera illuminates [default]
Off	The camera's Autofocus Assist light never illuminates

Recommendation:

1. Turn it **Off**, if possible. The light on the camera is annoying and poorly located (lens hoods and fingers tend to block it, rendering it ineffective). Instead, if you need autofocus assist, mount an external i-TTL flash and activate *its* Autofocus Assist lighting. Both the SB-600 and SB-800 have much wider patterns of lighting, and because these are a dim red, it's not intrusive.

Custom Setting #5 Lock Camera with No Secure Digital Card

(No memory card?)

As a safeguard to keep you from thinking you're taking pictures when you aren't, the D80 normally locks the shutter release when no Secure Digital card is present in the camera.

Release locked The shutter release locks if no card is present in the camera. [default]

Enable release The shutter release is unlocked and the camera operates normally (other than being able to save images) when no card is present in the camera.

Recommendations:

1. Generally, you'd leave the default in place. You usually don't want the camera to operate as if it is functioning when it isn't saving your images!
2. If you connect the camera to a computer and use Nikon Camera Control Pro to control the camera, you *don't* need to set this function to **Off**. Since images aren't recorded to the memory card at all, the shutter release is automatically enabled in this situation.
3. Personally, I'd suggest that you always leave a card in the camera and just leave this setting at the default. We digital shooters have enough things to deal with without adding yet another variable to our shoots.

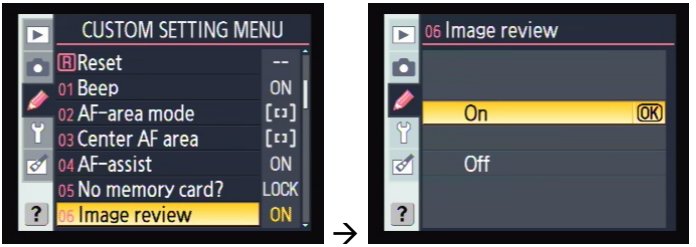
Custom Setting #6 Immediate Image Review

(Image review)

The D80 allows you to set whether images you've just taken appear immediately upon the color LCD for review:

On Images appear on the color LCD for about four seconds after being taken [default]

Off You must press the Play button (▶) to see images on the color LCD



Recommendation:

1. Turn this function **Off** and only manually review images when necessary if you wish to maximize battery performance.

Custom Setting #7 Automatic ISO Setting
(ISO auto)

Normally, the D80 uses specific ISO values you set (see "ISO Sensitivity" on page <245>). But you can set the camera to automatically boost ISO values (up to 1600) in low light situations. Nikon says "when optimal exposure cannot be achieved at the sensitivity selected by the user," which doesn't give you much indication of when the camera changes values.

Fortunately, Nikon made a change from the D100 where this function was originally implemented: the D80 displays an **ISO AUTO** indicator in both the top LCD and viewfinder when you've enabled the automatic ISO function. The D80 also shows the actual (adjusted) ISO value in both the viewfinder (if you press the **FUNC** button and have Custom Setting #16 set to the default) and blinks **ISO AUTO** to tell you when ISO values are being automatically changed by the camera. In other words, if you see **ISO AUTO** blinking in the viewfinder and have Custom Setting #16 set to the default, press the **FUNC** button to see what ISO the camera is setting.

The trigger that causes an ISO adjustment varies depending upon what exposure mode you're in:

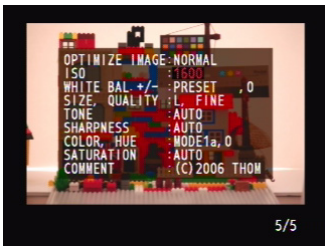
- In Shutter-priority exposure mode, the camera begins boosting the ISO when the shutter speed you select requires an aperture faster than the maximum aperture on the lens. The **ISO AUTO** in the viewfinder and on the top LCD begins blinking to warn you that the camera is changing ISO and the ISO value changes.
- In Manual exposure mode the camera boosts the ISO and keeps the exposure bar centered if the light (exposure) changes (in other words, it honors your aperture and shutter speed selection first and foremost). The **ISO AUTO** in the viewfinder and on the top LCD begin blinking to warn you that the camera is changing ISO and the ISO value itself changes. (Note that you can still overexpose or

underexpose an image in this situation—the camera doesn't have any ISO values below the base 100 and it won't go beyond 1600, either.)

- In Aperture-priority and Program exposure modes, the camera boosts the ISO only when you hit a shutter speed of 1/30 second (the default; you can also change this value in this function). The **ISO AUTO** in the viewfinder and on the back LCD begins blinking to warn you that the camera is changing ISO, and the ISO value itself changes.

Several other aspects of this function to watch out for:

- If the ISO value appears in red on the information pages for a photo after you've taken a shot, this indicates that the camera altered the ISO from what you set.



Note the red 1600 for ISO

- The ISO value displayed *in the menu system* is the ISO value *you* originally set, not the one that the camera may be setting. The ISO value shown on the top LCD and in the viewfinder may not agree with the one in the menu system once automatic adjustment occurs.
- If the flash is active (either internal or external) the camera *won't* alter the ISO value *unless* you have hit the range limit for the flash. In other words, if the flash would fire at anything less than full power, the ISO won't be boosted. If the flash would fire at full power and that's not enough light for the subject, the ISO *will* be boosted.
- The ISO value is adjusted in 1/6 stop increments using this function, not 1/3 stop increments.
- The camera will not set the **H0.3** through **H1.0** ISO values.

Another nice touch on the D80 is that you can set the *maximum* ISO value that the camera will set automatically. In

general, I find the D80 does a very good job at ISO 100 to 400, so for casual shooting I'll set the **Max. sensitivity** value to **400** and leave the AUTO ISO option **On**.

Off ISO values are those you specifically set and are not automatically altered by the camera [default]

On Under certain circumstances, and if the flash is not active, the camera boosts ISO values in low light

This function also allows you to set two additional parameters:

Max. Sensitivity The highest ISO value the camera will automatically set

Min. Shutter Speed The lowest shutter speed for Program and Aperture-priority exposure modes that will be honored before the ISO value is automatically adjusted

Recommendations:

1. Avoid using it all the time unless you set a restrictive **Max. sensitivity** value. You have to pay close attention to when it kicks in, and the caveats—such as flash turning it off most of the time—are often enough to get you the wrong results if you're not paying attention.

   In non-flash situations where a minimum shutter speed is absolutely needed (e.g. indoor basketball), the D80 doesn't get flying colors with the Auto ISO option: the upper limit of 1600 on the ISO puts a damper on things (in the gym I shoot in, I definitely need to sometimes hit ISO 3200 to keep the shutter speed at 1/500). Essentially, Auto ISO is merely a four-stop adjustment trying to live in a world where five and six stop adjustments are commonly needed. But, as long as you watch that ISO value in the viewfinder and are comfortable with what the camera is doing, then my previous total objection to this function (on previous Nikon DSLRs) should be considered lifted.

2. If you use the Automatic ISO setting only situationally, remember to immediately cancel it after each use. Generally, you want to be in control of the camera, not have it be in control of you.

3. Set the **Max. Sensitivity** and **Min. Shutter Speed**, if possible, to keep the automatic ISO adjustment from kicking in too early or making too much change. For example, as I noted in the ISO Sensitivity section on page <245>, I'm comfortable with the noise levels of the D80 up through ISO 400, so setting a **Max. Sensitivity** of **400** and leaving this function **On** is something some people, especially JPEG shooters, should consider (personally, I *always* opt for lower noise, when possible, as should most NEF shooters). Likewise, I usually can handhold down to 1/15, especially with the VR on the 18-200mm lens, so I often set that as my **Min. Shutter Speed** before the ISO adjustment kicks in.

Note: There is a hitch with this Custom Setting. If you try to set this option to **On** *when ISO* **H0.3**, **H0.7**, *or* **H1.0** *is already set on the camera, automatic ISO adjustment does not*

occur. Likewise, if you go to the SHOOTING menu *and try to change the ISO value to one of those three values, you'll find those options grayed out until you turn off Auto ISO.*

4. Note that this function *only* applies when using the Program, Aperture-priority, Shutter-priority, and Manual exposure modes. In the Scene exposure modes this Custom Setting is ignored.

Custom Setting #8 Grid Line Display in Viewfinder

(Grid display)

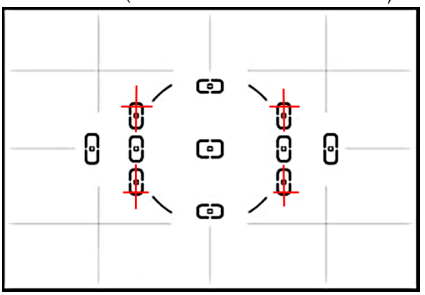
The D80 has the ability to show grid lines overlaid in the viewfinder, which help with alignment.

On	Grid lines are shown in the viewfinder
Off	Grid lines are not shown in the viewfinder [default]

Recommendations:

1. Your choice. I happen to like the gridlines. However, note that I've never found a Nikon viewfinder with them to be 100% perfectly aligned. Often the lines are a small fraction of a degree off from absolute horizontal and vertical.
2. For some reason, Nikon has chosen to put the grid lines at one-quarter points rather than the one-third points that many compose with. If you're a fan of the one-thirds framing rule (I'm not), the AF sensors give you a better

indicator (see red intersections, below):



3. Note that Custom Setting #16 allows you to program a *temporary* variant of this function. If you only sometimes use gridlines and don't need the **FUNC** button for anything else, consider using Custom Setting #16 instead of this Custom Setting.

Custom Setting #9 Viewfinder Warnings Display

(Viewfinder warning)

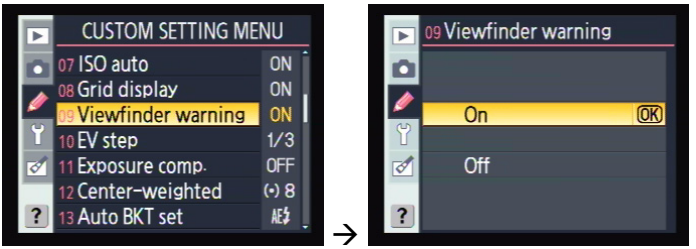
Another LCD overlay function in the viewfinder is a set of icons in the lower left corner to remind you when the battery is low, when you have no card in the camera (or the card is empty), and when you're shooting in black and white.

The warnings:

This is an either/or choice: you get all the warnings enabled or none:

On Camera displays the warnings [default]

Off Camera doesn't display warnings



Recommendation:

1. A good idea, but not fully fleshed out. There are more things I'd like to be warned about than shooting in black and white, low battery, and missing card. And I'd like to control which warnings would appear and which don't (otherwise you could end up with a lot of overlay icons in the image area). Most users should probably leave the warnings enabled, as having the battery status show up when low is a useful reminder that's hard to ignore.

Custom Setting #10 Exposure Control Increment

(EV step)

Exposure settings (apertures, shutter speeds, and bracketing, *but not exposure compensation*) that the D80 uses can be set in two different increments. The increment chosen with this setting is used for all exposure settings in the camera:

1/3 step 1/3 stop increments [default]

1/2 step 1/2 stop increments

Recommendations:

1. It really doesn't make much sense to set the alternative value *unless* you are simultaneously shooting with another camera body that doesn't support 1/3-stop increments (i.e. you want exposure settings to match between both cameras). If you set 1/2-stop increments, for instance, you could find yourself in situations where you're underexposing more than necessary to preserve highlight detail. Generally you want to set your brightest point as close to the top end of the D80's range as possible, and

1/3-stop increments allow you to get closer to the top end than 1/2 stop increments[115].

2. Note that this controls the apertures, shutter speeds, bracketing steps, exposure compensation and flash exposure compensation values that can be set.

Custom Setting #11 Exposure Compensation Control

(Exposure comp.)
This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

Some users think that pressing a button and turning a dial to set exposure compensation is less convenient than other possibilities. Again, Nikon allows you to change the behavior of the D80:

Off Exposure compensation requires holding in the ± button [default]

On Exposure compensation is set by rotating a Command dial without pressing the ± button. Which Command dial is used depends upon the exposure mode and whether you've switched the Command dials using Custom Setting #15:

CSM #15	*Exp Mode*	*Exposure Compensation set by*
OFF	A	Rear Command dial
OFF	S, P	Front Command dial
OFF	M	Rear Command dial
ON	A	Front Command dial
ON	S, P	Rear Command dial
ON	M	Rear Command dial

[115]Technically, we're talking about a 1/6 stop difference. But every little bit helps.

Recommendations:

1. Any Custom Setting that requires a table (see above) to understand the nuances of what each control does is, by my definition, confusing and to be avoided. Especially when the behavior changed is a default one on every Nikon body built to date (which makes changing between bodies problematic, especially if the other body doesn't have a custom setting to make this setting!). However, some D80 users only have one camera and always use their camera in one exposure mode (usually aperture-preferred), and thus find this custom setting useful. Your choice. But know what you're doing.
2. If you've used Nikon 35mm film bodies for any amount of time, the ± button is right where you expect it and works just as you'd expect. I never fiddle with this setting, as not all Nikons allow this Custom Setting. I prefer to have all my bodies work identically. Moreover, hold-button-and-twirl-dial is the basic tenet of Nikon's user interface. Violate it at your own risk.
3. Note that this function *only* applies when using the Program, Aperture-priority, Shutter-priority, and Manual exposure modes. In the Scene exposure modes this Custom Setting is ignored.

Custom Setting #12 Center-weight Circle Size

(Center-weighted)
This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

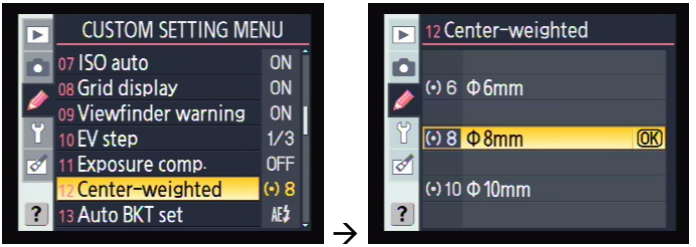
The center-weighted metering can be adjusted: you can choose the size of the inner circle that produces 75% of the

meter weighting. The default is 8mm, which is the size of the circle shown in the viewfinder. Your choices are:

6mm 6mm circle for 75%

8mm 8mm circle for 75% [default]

10mm 10mm circle for 75%



Recommendations:

1. This one is personal, and, I think, somewhat dependent upon the types of things you shoot. For example, landscape photographers might prefer to use 6mm to lower the potential impact of the sky on exposures. Likewise sports photographers might want to narrow their center weight circle if the playing field background isn't middle toned (e.g. ice hockey arenas, some basketball courts, etc.).
2. I'm not a big fan of center-weighted metering, so I simply leave my camera set on the default and use spot metering when I don't want to rely upon the matrix metering system. Center weighted metering is essentially a two-zone matrix that is heavily weighted to the central area. I find both those things somewhat limiting, though photographers used to older SLR metering systems may have developed exposure practices using center weighting and thus may prefer it.
3. Note that this function *only* applies when using the Program, Aperture-priority, Shutter-priority, and Manual exposure modes. In the Scene exposure modes this Custom Setting is ignored.

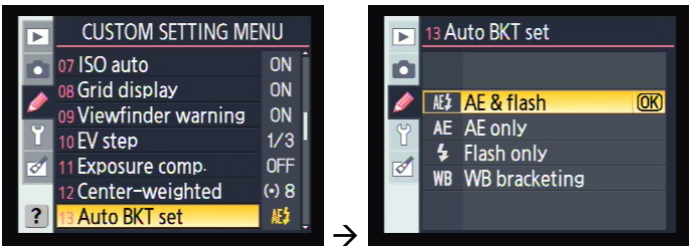
Custom Setting #13 Exposure Bracketing Method

(Auto BKT set)

This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

Exposure bracketing can be performed entirely with ambient exposure (e.g. altering aperture or shutter speed), with flash exposure (e.g. using flash exposure compensation), or both. This setting allows you to choose how the camera performs this bracketing (it also enables white balance bracketing):

AE & flash	If a Speedlight is attached, exposure bracketing is performed by using both flash exposure compensation and ambient exposure alteration [116] [default]
AE only	Bracketing is performed using only ambient exposure alteration
Flash only	Bracketing is performed using only flash exposure compensation
WB bracketing	White balance is bracketed *instead* of exposure



Recommendations:

1. This "feature" catches many users by surprise. Or it just puzzles them. But changing exposure via flash exposure compensation doesn't look the same as changing it via ambient exposure compensation. This is especially true if you've set flash mode options such as Slow Sync. The

[116] Aperture and shutter speed changes are used for ambient exposure alteration.

default setting is okay, but generally is not what all users want. I tend to leave my D80 on **AE only**, as I'm using Standard TTL and setting my own flash compensation value. If you use Balanced Fill-Flash, strongly consider leaving the default set.

2. White balance bracketing is an interesting option, though Nikon doesn't document it nearly well enough, and it would be more helpful if we saw real Kelvin values, not cryptic –1 and +1 indicators. Also, you only press the shutter release once when **WB bracketing** is set (unlike bracketing for exposure compensation). You still get your full number of shots, though, each with a different white balance setting. If you're wondering which white balance values are used, well, you need a white balance table handy to figure it out (see Page <280>). Even then, in Nikon's documentation it's not clear what happens. What if, for example, you want a bracket value of +2 but you're already set at, say, **Flash +2**[117]? Also, note that the camera doesn't bracket white balance when **WB bracketing** is set if you are taking NEF images (it won't even allow you to make bracketing active). In short: kudos for the idea; thumbs down for the execution.
3. Note that this function *only* applies when using the Program, Aperture-priority, Shutter-priority, and Manual exposure modes. In the Scene exposure modes this Custom Setting is ignored.

[117]I'll answer it: you get **Flash +4**! What the heck is that? Well, each white balance increment (other than in **Fluorescent**, where who knows what happens due to the channel imbalances introduced) is 10 MIRED (MicroREciprocal Degree, a way of calculating color temperature). The footnote in the manual about MIRED is trying to be helpful, and is better than the footnote in previous Nikon DSLR manuals (p.37), but still a bit unclear. Amusingly, Nikon only gives you a way of calculating MIRED from the color temperature difference, and not vice versa, which is what you need. (I'm wondering if the source for this is page 43 of my *Nikon Field Guide*). Put a more useful way, each 10 MIRED shift is equivalent to using an 81 or 82 filter (depends upon which way you're going). A 20 MIRED shift is like an 81A or 82A, a 30 MIRED shift is like an 81B or 82B, etc.

Custom Setting #14 Bracketing Order

(Auto BKT order)

This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

You can select the order in which the D80 exposes the photographs when automatic bracketing is set (see "Exposure Bracketing" on page <263>):

Note: Bracketing can set sequences fewer than three exposures. The bracketing order describes what happens when at least three exposures are taken. If you've set bracketing to two-shot sequences, the orders shown below are still correct, but one of the values is left off. For example, if you asked the camera to set bracketing to **-2F 0.5**, *the "overexposed" value is not taken, so just ignore its place in the order. If you set the camera to bracket more than three images, the orders shown below are correct: extra – and + compensation values are performed in order of lowest exposure to highest.*

Default order Correct exposure first, then underexposed, then overexposed [default]

Under>MTR>Over Underexposed first, then correct exposure, then overexposed

Recommendations:

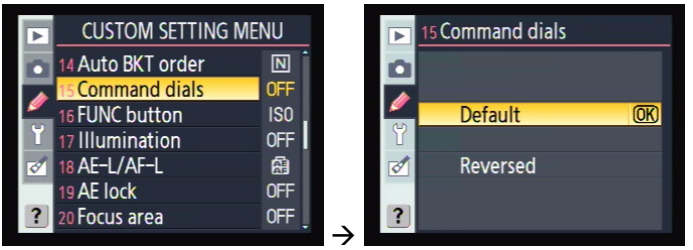
1. Pick one and use only that setting. This is one of those things where consistency is preferable. Since the D80 names every file only with numbers, this becomes even more important. (You could browse through the EXIF data to figure out which is which.)

2. I personally prefer to have my numbered images go from underexposure to overexposure, so I select **Under>MTR>Over**. That's because that's the way I used to set up bracket sequences on the light box when reviewing slides. I'm used to seeing values from low to high.
3. Note that the order applies to *flash-only* and *white balance bracketing*, as well. This is another reason why I like them in order—any time I see a bracketing sequence of shots, I know that they go from low to high in whatever is bracketed.
4. Note that this function *only* applies when using the Program, Aperture-priority, Shutter-priority, and Manual exposure modes. In the Scene exposure modes this Custom Setting is ignored.

Custom Setting #15 Command Dial Functions

(Command dials)
This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

Some users think that the Front Command dial is not as convenient as the Rear Command dial for setting apertures. Others don't like the direction the controls work (e.g. clockwise increases apertures normally). Fortunately, you can override four of Nikon's choices with this custom setting.



Default Operation is as described in the manual [default]

Reversed The Command dial functions are reversed (e.g. apertures are now controlled by the Rear Command dial instead of the Front)

Recommendations:

1. I don't have a problem with the way Nikon designed things to work, and perhaps other than the ability to use the aperture ring option don't see any compelling features here. At least the D80 has both Command dials on the MB-D80 vertical release, so you don't get into a situation where you can't do something with one release you can with the other.
2. If you also use any Nikon body that doesn't have all these custom functions (e.g. D50), leave the D80 set on the defaults, otherwise you're likely to get confused when you move back and forth between bodies.
3. Note that this function *only* applies when using the Program, Aperture-priority, Shutter-priority, and Manual exposure modes. In the Scene exposure modes this Custom Setting is ignored.

Custom Setting #16 FUNC Button Setting

(FUNC button)
This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

The **FUNC** button on the front of the camera can be programmed to do one of many useful things:

ISO display	The current [118] ISO value is displayed in the viewfinder [default]
Framing grid	Essentially provides a temporary equivalent to Custom Setting #8 (Grid Line Display); use Rear Command dial

[118] The Nikon manual says "modified value" which may confuse you. What they're trying to say is that the current ISO value that will be used is displayed. If Custom Setting #7 (Auto ISO) is **Off**, then this is the value *you* set. If Custom Setting #7 (Auto ISO) is **On**, then it will be the value the camera is currently setting, which may override the value you set. Note that Auto ISO is sensitive to exposure, so your camera must be pointing at the scene as you'll expose it to get an accurate indication of what ISO will be used.

	to turn gridlines on or off while pressing the **FUNC** button.
AF-area mode	Provides a quick alternative to Custom Setting #2; use Rear Command dial to change the AF-area mode while pressing the **FUNC** button.
Center AF area	Provides a quick alternative to Custom Setting #3; use Rear Command dial to change the central AF area width while pressing the **FUNC** button.
FV lock	A preflash is performed once and the value for subsequent flash locked when the button is pressed; a second press cancels **FV Lock.**
Flash off	The internal or external flash is turned off while the button is held down
Matrix Metering	Matrix metering is active when the **FUNC** button is held down (Program, Aperture-priority, Shutter-priority, and Manual exposure modes only)
Center-Weighted	Center-weighted metering is active when the **FUNC** button is held down (Program, Aperture-priority, Shutter-priority, and Manual exposure modes only)
Spot Metering	Spot metering is active when the **FUNC** button is held down (Program, Aperture-priority, Shutter-priority, and Manual exposure modes only)

Recommendations:

1. Welcome to the mother lode. If there's any Custom Setting option you want to spend some time studying and considering how to set, this is the one. This is a bit like having programmable function keys on your computer keyboard: each of us will approach this option differently, but we'll all find it useful. I'll only touch on a few of the possibilities.
2. First, the default is useful, as it gives you the ability to see what the camera is setting when Custom Setting #7 is turned on. Indeed, if you've got Auto ISO turned on and are at all concerned about what ISO the camera is setting, the default should probably be what you use the **FUNC** button for.
3. Because the preflash occurs before the mirror goes up on the D80, there's just enough of a pause between the preflash and main flash that you might get "blinkers" (people blinking in reaction to the pre-flash [119]). If you do, setting **FV lock** is the solution: press the **FUNC** button to get a flash reading and then shoot away; the camera won't preflash again until you press the **FUNC** button again to restore normal preflash. (Note: the flash has to be in a TTL mode for this to work; other flash modes don't preflash!)
4. I tend to use matrix metering most of the time, but every now and then I find myself in situations where I want to

[119] Statistics say that most "fast blinkers" react in about 100ms. The D80 has a faster shutter lag than this, so the preflash on the D80 doesn't usually trigger blinking. Still, there are some people who are extremely fast blinkers who might be in the act of blinking by the time the D80 flash goes off in exposure (especially true if you've set Rear Sync).

check areas of a scene with the spot meter. Now I can do just that without changing the Metering Method dial on the back of the camera (where I might accidentally leave it in a wrong position). By setting **Spot metering** for the **FUNC** button, I have one-button, temporary spot metering function at my fingertips; it's also easy to see the change in exposure settings as I press and release the button.

5. **Flash off** might not sound like a useful function at first, but think again. If you're trying to quickly evaluate the ambient/flash balance in exposures (i.e. how much impact the flash is having), being able to hold the **FUNC** button while taking an exposure gives you a quick way of getting just the ambient exposure. Take one shot with flash and ambient, one with ambient only. Now in playback, bounce back and forth comparing the two. This is more convenient than it sounds. Your alternative, if you're in anything other than Shutter-priority or Manual exposure mode, can be impossible to achieve by just pushing down and popping up the flash (that's because of the various constraints the other exposure modes may put on the ambient exposure). Also, note that **Flash off** is the only way to cancel flash in some of the Scene exposure modes.

Custom Setting #17 LCD Illumination Control

(Illumination)
This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

The top LCD has a yellow-green backlighting that makes it easier to see at night. To preserve power, the backlighting isn't applied unless you specifically tell it to. By default, that is done by turning the Power switch to the illumination icon (☀, just past the **On** position), which provides backlighting for about six seconds. You can change this behavior:

Off	Backlighting controlled by power switch [default]
On	Backlighting occurs when meter is active

Recommendations:

1. Nikon has made a change since the D2 series first came out: the alternate setting on the D2 series was triggered by pressing any button on the camera (shutter release partway, and of the control buttons), and was of limited duration (6 seconds). Now, the system also looks at if the camera is active (metering) and backlights the LCD during the entire time the camera is active. For some heavy-handed users (or if you have Custom Setting #28 set to a longer value than default), that can be very long periods of time. The drawback is that battery consumption is increased by this backlighting, and it is already high when the camera is active. Thus, I say you should only set this control for situational conditions (i.e. when you need it). All other times it should be **Off**.
2. Most people don't realize it, but this function is also linked to external Speedlight LCDs, and it works both ways. If you set backlighting to be **On** for the SB-800 using its options, that setting is applied to the camera, too! Any time the flash backlight is triggered, the camera's lighting will be triggered, too (such as coming out of Standby mode). Indeed, since I'm usually shooting with a flash on the camera at night, I simply leave backlighting set on my SB-800 and leave the camera's #17 option set to **Off**. Just remember that you've done this.

Custom Setting #18 AE-Lock Button Function

(AE-L/AF-L)

This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

The exposure lock and focus lock button, labeled **AE-L/AF-L**, can be changed to perform one of several functions:

AE/AF lock	Exposure and autofocus are locked when the button is held down [default]
AE lock only	Only exposure is locked when the button is held down (focus is unaffected)
AE lock hold	Only exposure is locked when the button is pressed and is kept locked until pressed a second time or the exposure meter turns off (focus is unaffected)
AF lock	Only autofocus is locked while the button is pressed and held (exposure is unaffected)
AF-On	Autofocus is initiated when the button is pressed (the shutter release no longer initiates autofocus)
FV lock	Any active flash is checked for exposure value by firing a preflash and that exposure is then kept until the button is pressed to generate another preflash sequence
Focus area selection	Hold the button and rotate the Front Command dial to select the focus area
AE-L/AF-L/AF area	Combines **AE/AF-lock** and **Focus area selection** options (i.e. both are active)

AE-L/AF area	Combines **AE lock only** and **Focus area selection** options (i.e. both are active)
AF-L/AF area	Combines **AF lock** and **Focus area selection** options (i.e. both are active)
AF-ON/AF area	Combines **AF-On** and **Focus area selection** options (i.e. both are active)

Recommendations:
This is a very useful control, so it's too bad that it's buried deep in the bowels of Custom Settings and modestly documented:

1. **AF lock** is useful when you want to preset focus on a particular spot (e.g. the finish line of a foot race) but because of changing lighting conditions, you don't want the exposure to be set until you take the picture. Of course, you could set the camera to manual focus to achieve the same thing. I used to leave my D80 set to **AF lock**, but I found that autofocus can be quickly locked in a similar fashion by flicking the autofocus mode switch on the front of the camera to **MF** (or on some Nikkor lenses, toggling their AF/MF switch). So I don't often set this value, anymore; the other possibilities are more interesting, and you only get to choose one.
2. **AE lock only** is useful when you take an exposure reading and then reorient the camera for the final composition. Setting **AE/AF lock** sometimes gets in the way of this, as where you point the camera for exposure

setting may not be the correct subject-to-camera distance for focus. **AE lock only** is where I usually leave my D80 (and D70, D100, D200, D1X, D2hs, D2x, F100, F5, and F6) set.

3. The difference between **AE lock only** and **AE lock hold** is subtle, but important. The former only locks the exposure while you hold down the button. The latter locks the exposure at the moment you press the button and keeps the exposure lock after you release the button (or until the meter delay times out). If you set **AE lock hold** you might want to consider setting a longer meter timeout (Custom Setting #28).
4. The combined settings (e.g. **AE-L/AF-L/AF area**) are there for MB-D80 users. The reach to the Direction pad is quite large when using the vertical shutter release on the MB-D80, so you use the convenient **AE-L/AF-L** button on the MB-D80 in conjunction with the Front Command dial to change AF sensors. Indeed, if you use the MB-D80, I think you'll quickly discover that you want to set one of these combo settings.

Custom Setting #19 AE Lock Behavior

(AE lock)
This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

Most cameras automatically lock the exposure when the shutter release is pressed partway, but the D80 (and many other Nikon bodies) behave differently:

Off	Exposure locks only when the **AE-L/AF-L** button is pressed [default]
On	Exposure locks when *either* the shutter release is held partway down or the **AE-L/AF-L** button is held.

Recommendations:

1. If you're used to having exposure lock when you press the shutter release partway—the behavior of most consumer cameras—then consider setting this option to a value of **On**. Note that if you like to set exposure and then pan over to your final composition, you need to either set this option or get in the habit of using the **AE-L/AF-L** button.

2. A little known fact about the **AE-L/AF-L** button is that it doesn't actually lock the aperture and shutter speed: it locks the overall exposure. In the automated exposure modes you can actually hold the button in and then use the Front and/or Rear Command dials (depending upon your exposure mode setting) to change the combination of aperture/shutter speed that is used—the overall exposure will remain locked. In other words, with the exposure "locked" in Aperture-priority exposure mode, turning the Front Command dial to get the next smaller aperture (e.g. f/8 instead of f/5.6) would cause the camera to use the next longer shutter speed (e.g. 1/125 instead of 1/250).

Custom Setting #20 Focus Area Selection Wrap

(Focus area)
This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

The Direction pad on the back of the camera is used to select which autofocus area to use. You can change the behavior of repeatedly pressing the Direction pad:

No Wrap Repeated presses stop sensor selection at edge of display [default]

Wrap Repeated presses wrap selection around to the opposite side of the display (but continue in the same direction).

Recommendation:

1. I like the wrap-around effect, but you'll need to try both options to figure out which you like better.

Custom Setting #21 Focus Area Illumination

(AF Area Illumination)
This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

The focus area indicators in the viewfinder normally light up briefly in red to indicate which one (or ones) is being used to initiate focus. This particular option causes a great deal of confusion amongst users, as the Nikon manual is a bit scattered about how the lighted sensors work and Nikon falls into the trap of name overlap. But before I get into that, let's look at the options:

Auto Sensors only use brief red highlight when necessary to distinguish due to scene brightness [default]

On Sensors always light briefly in red to show which one will be used for focus information

Off Sensors never light in red

Recommendations:

1. Personally, I like the default. In dim light I get the brief red boost to help find the selected sensor, in bright light the black outline is good enough.
2. You're probably wondering why you might want to turn this off. One word: power. If you set **On**, you'll be using a tiny bit more power every time you move autofocus around. The default is a good balance between power consumption and visibility, but if you're a power miser, select **Off**.

Custom Setting #22 Flash Mode for Internal Flash

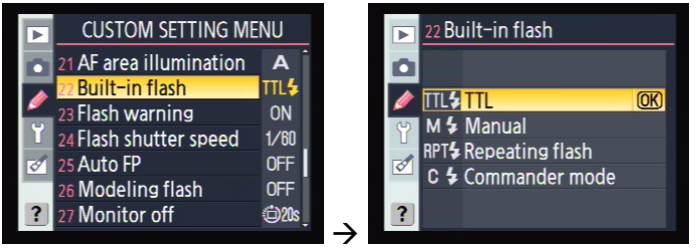
(Built-in flash)
This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

I wish Nikon had set flash mode up differently (e.g. put the flash mode control into the Flash Pop-up button in conjunction with the command dials). Because buried down in the Custom Settings menus—and requiring multiple settings for some functions—partially negates a very useful feature. Nikon needed a way to control what method the internal flash uses to calculate flash exposure and set advanced flash options when it's popped up, and this is where we set that. Just be forewarned that this gets a little involved (especially if you haven't read the flash section that starts on page <444> yet):

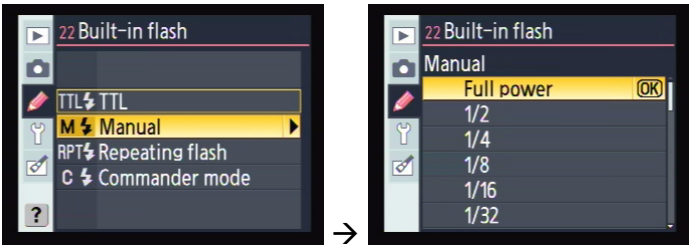
TTL	TTL used for flash mode [default]
Manual	Manual flash mode

Repeating Flash Repeating flash mode

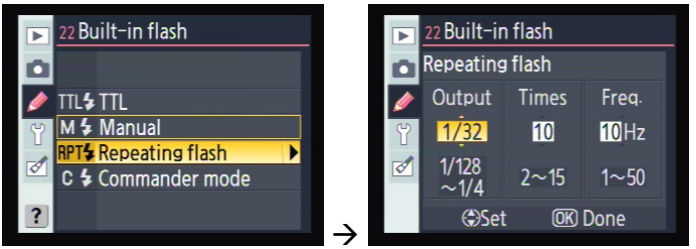
Commander Mode Internal flash used to control other flashes



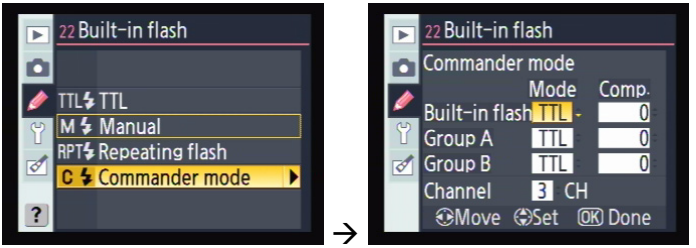
If you set **Manual**, you also need to select a power setting (see the section on Internal Manual flash on page <471> for GNs):



If you set **Repeating flash**, you also need to set the power setting (suddenly renamed **Output** in this menu by Nikon), the number of times to repeat the flash during the shot, and the interval at which the flash is repeated. This is a little complex to figure out, as there's an interaction between your shutter speed, **Times**, and **Interval** that potentially gives you something other than you want (see my Recommendations, below):



If you set **Commander mode**, you're telling the camera that you want to use the internal flash for wireless flash control of remote flash units. You then need to set the flash mode and flash exposure compensation for each and every flash *group*, including the internal flash (I'll have more to say about this in the section on wireless flash on page <476>):



Recommendations:

1. If you're going to use **Repeating flash**, start by first picking a power level (**Output**). That's because Repeating flash is the same as Manual flash in terms of exposure calculations. Next, you need to determine the shutter speed you're going to use. Let's say your shutter speed will be 1/60. Next, set **Freq** to determine how many flashes will be fired per second. A frequency [120] of 1Hz means 1 times per second, so we need to divide the lower value of our shutter speed (60) into this, which tells us that we could have as many as 1 flash while the shutter is open, which obviously isn't going to generate a "repeating" flash effect. By contrast, if your shutter speed was 1/2 and your **Freq** was **10hz**, you could get as many as 5 flashes into your shot. You'll need to tweak your shutter speed and **Freq** until you get a meaningful potential set of repetitions. Finally, set **Times** to a value less than or equal to what you just calculated. Unfortunately, this, too, has a caveat, as you can only set certain **Times** values for certain **Output** levels:

[120] If you're used other Nikon flash equipment, you'll note that Nikon has changed the name from **Interval** to **Freq** (or frequency).

1/4 Power	2
1/8 Power	2-5
1/16 Power	2-10
1/32 Power	2-10, 15
1/64 Power	2-10, 15, 20, 25
1/128 Power	2-10, 15, 20, 25, 30, 35

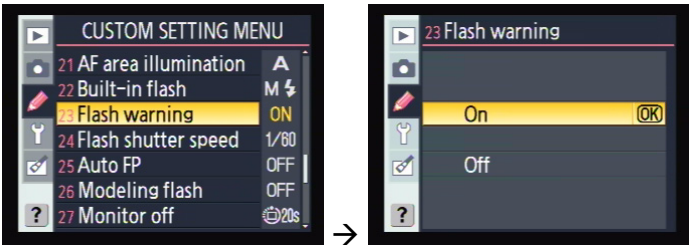
2. **Commander mode** may be where you want to leave your camera set if you *sometimes* use wireless flash. That's because you can still run the internal flash just on its own for TTL at this setting. You have to set the flash exposure compensation in this Custom Setting rather than using the Flash Options button and Front Command dial on the camera, though. And you need to be aware that you'll extend the preflash sequence a bit because the camera has to look for other groups, so this might not be a good idea if you're shooting people or things that react to light. But for someone like me, who tends to shoot static objects (scenics) and often, but not always, uses multiple flashes, leaving my D80 set to **Commander mode** with my usual settings actually saves me a lot of time and fumbling in the field (especially since it's usually around dawn or dusk when I'm shooting with flash). I deal with Commander mode in detail in the section on wireless flash that begins on page <476>.
3. If you use visual slaves to trigger studio lighting, try leaving your D80 set at **Manual** flash mode at **1/128** power. That's generally not enough flash to do much more than produce a minor catchlight effect on your models, but it's usually enough to trigger you main studio lighting.
4. Note that this function *only* applies when using the Program, Aperture-priority, Shutter-priority, and Manual exposure modes. In the Scene exposure modes this Custom Setting is ignored.

Custom Setting #23 Flash Warning in Viewfinder

(Flash warning)
This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

The ⚡ icon in the viewfinder is flashed in low light to indicate that flash probably should be used. Your choices are:

On	Low light flash warning given [default]
Off	Flash warning never given



Recommendations:

1. If you really need a flash warning, you're probably using Scene exposure modes, where the flash is automatically activated. Advanced users should turn this function off so that they don't get the blinking ⚡ icon caused by full power flash confused with the "need flash" warning.
2. Note that this function *only* applies when using the Program, Aperture-priority, Shutter-priority, and Manual exposure modes. In the Scene exposure modes this Custom Setting is ignored.

Custom Setting #24 Flash Shutter Speed Barrier

(Flash shutter speed)
This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

The section on flash that comes later in the eBook (see "Setting Flash Options" on page <458>) describes an option called Slow Sync. Essentially, the camera places a lower limit

on the shutter speed that can be used when flash is active *unless* you tell it to ignore that limit. Custom Setting #24 allows you to modify the limit (and the Slow Sync option allows you to remove the limit):

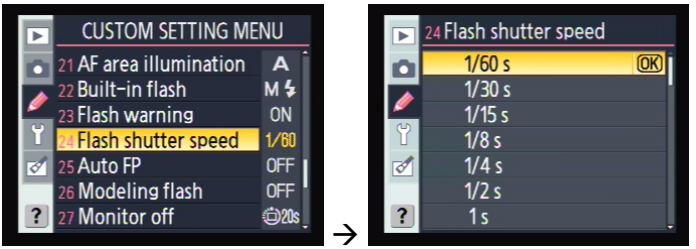
1/60 1/60 second lower limit [default]

1/30 1/30 second lower limit

1/15 1/15 second lower limit

1/8 1/8 second lower limit

1/4 1/4 second lower limit



Recommendations:

1. I believe everyone should set at least **1/30**. Nikon's **1/60** default is very conservative, and will cause problems in most indoor lighting situations (for the reason why, read the full flash section).
2. I personally set **1/15** because I know I can usually hand hold the camera to that level when using flash as I describe, and it's the slowest speed where subject motion in the ambient exposure doesn't become a constant problem (it may be a bit of a problem at 1/15, but I watch for that).
3. Note that this function *only* applies when using the Program, Aperture-priority, Shutter-priority, and Manual exposure modes. In the Scene exposure modes this Custom Setting is ignored.

Custom Setting #25 FP Flash Activation

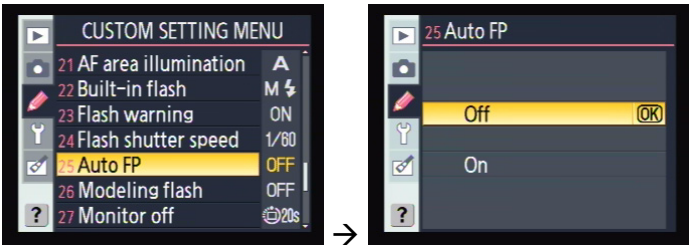
(Auto FP)

This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

Normally the D80 restricts flash use to shutter speeds of 1/200 or slower. With the internal, SB-600, SB-800, and SB-R200 flash units, you can have them use a different technique for lighting a scene (continuous pulses of flash), called FP. This lowers the power of the flash, but allows the use of *any* shutter speed.

On FP will be utilized above 1/200

Off Only the regular "single pop" flash system is used, which restricts shutter speeds to 1/200 [default]



Recommendations:

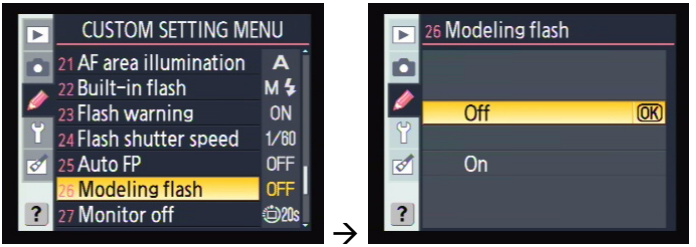
1. The default is backwards and I recommend you set this function to **On**. It's rare that you'd want to turn this off, as it places an arbitrary limit on when flash can be used. Nikon appears to be using the default as a way of reminding you that flash power will be lowered at fast shutter speeds.
2. FP works for Auto Aperture, TTL, and Manual flash modes (assuming the flash supports them).
3. Note that this function *only* applies when using the Program, Aperture-priority, Shutter-priority, and Manual exposure modes. In the Scene exposure modes this Custom Setting is ignored.

Custom Setting #26 DOF Preview Triggers Modeling Flash
(Modeling flash)
This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

The internal flash, SB-600, and SB-800 have a modeling light, which triggers the flash to rapidly pulse the flash at low power. This is handy for seeing how lighting hits your subject and what shadows might be triggered. I find this especially useful for estimating shadows in macro photography with flash. Normally, you'd have to reach all the way up onto the flash and press the modeling light button to trigger this function (and you'd have no way of doing it all on the internal flash or SB-600), but this custom setting allows you to not move your hand positions to trigger the modeling light:

On DOF Preview button triggers modeling light

Off DOF Preview button does not trigger modeling light [default]



Recommendations:

1. Leave it **On** unless you're in some situation where you need the DOF Preview and don't want your subject to be startled by flash.
2. Two types of photographers get the most benefit out of this setting: (a) those who work with flash in a flash bracket or further off camera (they can't always conveniently press the SB-800's Modeling Light button); and (b) macro shooters who are trying to evaluate how shadows and depth of field interact.
3. Surprise, surprise. The SB-600, which does *not* have a modeling light button, *does* have a modeling light

function. I had initially missed that paragraph in the SB-600 manual, but the D2x's manual made me test it: it works, on the D2 series, D200, and D80.

4. Note that this function *only* applies when using the Program, Aperture-priority, Shutter-priority, and Manual exposure modes. In the Scene exposure modes this Custom Setting is ignored.

Custom Setting #27 Color LCD Active Time

(Monitor-off)

This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

The D80 uses more battery power when the color LCD is active. This function allows you to program the amount of time the LCD stays active when no other activity (button pushing) takes place. Normally, the monitor stays active for 4 seconds for automatic image review and 20 seconds after any other activity. The "other activity" delay can be changed:

10 s	Ten second delay before the color LCD is turned off
20 s	Twenty second delay before the color LCD is turned off [default]
1 min.	One minute delay before the color LCD is turned off
5 min.	Five minute delay before the color LCD is turned off
10 min.	Ten minute delay before the color LCD is turned off

Recommendations:

1. If you can tolerate it, change the delay time to a 10-second value. You'll get slightly more exposures per battery charge (assuming you work quickly and setting the timeout lower doesn't force you to turn on the color LCD more often).
2. Avoid the 1 to 10-minute delays unless you have extra batteries.
3. If you're working with AC power or any battery connected to the DC In connector, you don't need to worry about this setting—it is automatically set to 10 minutes and you can't alter that.

Custom Setting #28 Meter/Camera Active Time

(Auto meter-off)
This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

The D80, like all Nikon bodies, has a higher power demand when it is active (metering, autofocus, etc.). Thus, Nikon has programmed an aggressive time-out for the camera's basic functions. Normally, the camera stays active only while the shutter release is held partway down, and for ten seconds after you release it. This delay can be changed:

4 s	Four second delay before camera goes inactive
6 s	Six second delay before camera goes inactive [default]
8 s	Eight second delay before camera goes inactive
16 s	Sixteen second delay before camera goes inactive
30 s	Thirty second delay before camera goes inactive
30 m	Thirty *minute* delay before camera goes inactive

Recommendations:

1. If you can tolerate it, change the camera to a 4-second timeout. You'll get slightly more exposures per battery charge (assuming you work quickly and setting the timeout lower doesn't force you to trigger the meter more often).
2. Avoid the 16-second delay and longer settings unless you have extra batteries.
3. If you use an external power source, you don't need to worry about this setting, as the camera sets a value of 10 minutes as long as power is plugged into the **DC In** socket.

Custom Setting #29 Self Timer Delay Setting

(Self-timer)
This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

The D80 allows you to set four different delay times for the self timer (the delay time is the time between pressing the shutter release and the shutter actually being opened for exposure):

2s	Two second delay
5s	Five second delay
10s	Ten second delay [default]
20s	Twenty second delay

Recommendations:

1. If all you're looking for is a short delay to counter any camera movement triggered by your pressing the shutter release, use the 2-second delay. Better still, consider using the infrared remote controller (see "Remote Control" on page <347>) and combining that with Custom Setting #31 (Exp. Delay Mode; see page <441>).
2. Remember, the white self timer lamp on the front of the camera tells you the status of the countdown. It flashes during the first part and then lights steadily during the last two seconds prior to exposure. If you've set Custom Setting #1 (Sound Feedback), the camera also beeps at you during the self timer countdown.

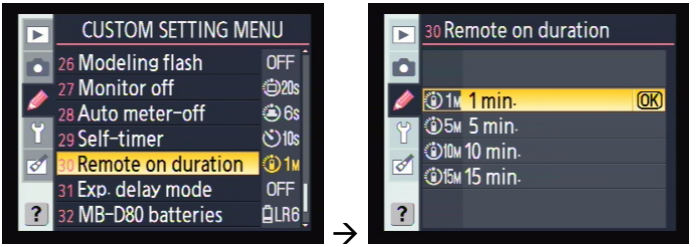
Custom Setting #30 Remote Control Activation Time

(Remote On Duration)

This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

The D80 allows you to set four different times for how long the remote control signal will be looked for before the camera automatically cancels the function. This setting is needed to conserve battery power (the camera consumes more power when it is looking for the remote).

1 min	One minute active length [default]
5 min	Five minute active length
10 min	Ten minute active length
15 min	Fifteen minute active length



Recommendation:

1. Keep it as short as you dare. Generally I find Nikon's default works fine for me, but some people will want to set the active timer to **5 min**.

Custom Setting #31 Shutter Delay

(Exp. delay mode)

This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

This option is used to reduce vibrations or camera shake caused by the shutter press and mirror flip. When activated, the camera flips the mirror up *immediately* upon shutter release, and then opens the shutter about 0.4 seconds later (the mirror is lowered after the shot).

Off camera works normally [default]

On mirror lifted 0.4 seconds before shutter opens

Recommendations:

1. Remember that exposure will be calculated before the mirror goes up. Thus in situations where light is changing rapidly (fireworks, light shows, etc.) it might not be a good option if you're relying upon the automatic exposure

calculations. (*Hint*: learn how to set manual exposures, then anticipate the light changes.)

2. Likewise, flash exposures are calculated before the mirror goes up, so you'll see a preflash on pressing the shutter release, then the main flash 0.4 seconds later when the shutter opens. For most subjects, that is probably okay, but be careful of subjects that will be startled by the preflash. Some people will blink in response to the preflash and may have their eyes closed at the main flash. Some insects and animals will bolt on the preflash.
3. This timed shutter lag works best for static subjects (some people and animals react to hearing the mirror flip).

Custom Setting #32 Battery Type in MB-D80

(MB-D80 batteries)
This option will not appear unless **CSM/Setup menu** *(on the SETUP menu) is set to* **Detailed**.

If you use AA batteries in the optional MB-D80, you need to tell the camera what type they are. That's because different types of batteries not only have different voltages, but they also change voltage at different rates as they expire:

LR6 (Alkaline) Use for AA Alkaline batteries [default]

HR6 (Ni-MH) Use for rechargeable AA Nickel-Metal Hydride batteries

FR6 (Lithium) Use for AA lithium batteries, such as the Eveready Lithium series

ZR6 (Ni-Mn) Use for AA Nickel-Manganese batteries (rare)

Recommendation:

1. You ***must*** set this function if you use AA batteries in the MB-D80; otherwise you won't get accurate and reliable power indication. In some cases, the camera could report the battery exhausted when it is isn't.
2. You ***don't*** set this function if you use EN-EL3e batteries in the MB-D80; the D80 detects those automatically.
3. So what type of battery should you use in the MB-D80? EN-EL3e batteries are the first choice, by far. First, they're rechargeable, which is good for the environment. But they'll also provide the longest shooting time and ultimately do so at the lowest expense. Using AA batteries in the MB-D80 is there as an emergency capability, in my opinion. Thus, you use what you've got. For me, that's NiMH batteries, since I'm always carrying extras for use in my flash units. Lithium AA batteries are expensive, and disposing of lithium isn't exactly something you want to do regularly—it's not a great environmental friend, though it's better than some of the other materials batteries have been made of. Alkaline AA batteries are cheap and ubiquitous, but they won't last as long as NiMH or Lithium batteries.

Using Flash

Flash use with a D80 is different than with many previous Nikon SLRs (only the current Nikon DSLRs—D50, D70, D2 series, and D200—share the D80's flash capabilities).

Obviously, I'd love for all readers of this book to rush out and purchase my Nikon Digital Flash Guide. *If you'd like an extended discussion of TTL modes and how flash works, consider purchasing it. For most D80 users, though, the sections that follow are probably all you need for basic flash use.*

What Happens When Flash is Used

Flash isn't a magical device that simply fixes every lighting problem you're facing. Like any tool, you need to understand how it works and how to best use it. The big "gotchas" I encounter most frequently with students are these:

- *Flash only lights one distance correctly*. Light falls off with the inverse square of the distance. If a flash is providing the correct light for 8 feet, by 11 feet the light will be one stop less; at 5.6 feet it will be one stop more. The classic expectation most people have is that flash should light both a subject and a background that's many feet behind the subject. Won't happen.
- *Two exposures occur when you use flash*. Both have to be right. This is an extension of the first thing I presented: if flash is lighting only a subject at one distance correctly, something else has to provide the exposure for the background (ambient) areas. That "something else" is the same thing it always is: the existing light, and the aperture, shutter speed, and ISO are the variables you use to control them. The flash (subject) exposure, meanwhile, is controlled by flash power, aperture, and ISO. Note that

only aperture and ISO overlap between the two exposures.

When set to the defaults, the D80 does its best guess at making everything work "magically." As you'll learn in a bit, the default settings for the camera are to "balance" flash and ambient lighting (what Nikon calls **TTL BL**). That's not always what you want it to do, and there are things that can keep the camera from succeeding at that.

Flash Basics

A flash produces a burst of light by pushing an electronic pulse across Xenon gas, which causes it to react. It does this in response to a signal from the camera that it's time to produce flash. For flashes with variable power ability, such as those found in the Speedlight models and the internal flash, the amount of light actually produced is determined by when the electrical signal to the Xenon is shut off:

- When a flash fires at full power, it essentially gives everything it has: the Xenon gas responds as much as it can and eventually decays to nothing. That takes about 1/1050 of a second on an SB-800.
- When a flash fires at less than full power, this is done by stifling the Xenon flash prematurely by removing the electrical impulse. On an SB-800, for example, the "flash" can be shut off in as little as 1/41,600 of a second (1/128 power).

In order to have any variability in flash output something has to measure the amounts of light produced and make the decision of when to shut the flash off. Either the D80 or the flash itself can both measure and control the amount of light.

Yes, this means that the D80 has something inside it that measures the light produced by the flash (the 420-pixel CCD in the viewfinder is used for this job [121]). Like the ambient exposure, the CCD must get its measurements *before* the picture is taken, which is why you'll see references to something called the preflash [122]. Why before the exposure? Because the D80 has no way to measure the flash output *during* the exposure (none of the Nikon digital SLRs do).

If you're starting to think that there may be more "modes" and settings coming, you're right. Flash exposure is no different than regular exposure: you have to set the camera/flash to do what you want it to. And there are lots of options you need to know about.

Digital Flash Differences

For 35mm film cameras, Nikon TTL [123] flash sensors are designed to look at reflections off the shutter curtain before exposure *and* again off the film during exposure. But the D80 doesn't have any film, and the sensor doesn't reflect light the same way that film does, so this second exposure test isn't performed.

Nikon originally decided to modify its flash system slightly for digital cameras to include a new flash "mode," called D-TTL,

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[121] Note that one way the D2 series and the D80 differ is that the D2 series has an additional five-segment sensor in the mirror box, which looks at the shutter curtain. This has subtle but real implications. The D80, for example, fires a preflash at the first shutter release press when set to **M-Up**, the D2 series waits until the second, thus putting the flash calculations closer to the actual picture taking.

[122] The name preflash is a little misleading. Most newcomers expect to always see a separate flash from the main flash. But the preflash usually occurs so close to the actual flash that you usually don't distinguish it from the main flash. If you don't believe me, set your D80 to Shutter Delay (Custom Setting #31) with the flash popped up and in a TTL mode. Press the shutter release. The mirror goes up, but before it does, the camera fires the preflash. Press the shutter release again. The curtain now opens and the flash is fired at the power calculated by the preflash. At any shutter speed faster than 1/8 the preflash and flash are close enough together that many people can't distinguish them.

[123] Just a reminder: TTL stands for Through the Lens. Flash measurements are performed *by the camera* looking through the lens. In theory, this is the most accurate flash capability.

or Digital TTL. D-TTL is supported by the D1 series, the D100, and the D2 series with the SB-28DX, SB-50DX, SB-80DX, SB-600, and SB-800 being the only flashes that can be used for TTL. Other flash units, including the original SB-28, *cannot be used in TTL flash modes with these Nikon DSLRs*. Indeed, if you attempt to do so, the shutter release locks and you can't take pictures until you set the Speedlight to Automatic (A) or Manual (M) flash modes.

With the D2h introduction, Nikon updated the flash system a second time to something Nikon calls i-TTL (they also call the entire set of new flash capabilities CLS, for Creative Lighting System). The D50, D70 series, D2 series, D200, and D80 share this new capability. Unfortunately, a side effect of the i-TTL update is that *only* the SB-400, SB-600, SB-800, SB-R200, and internal flashes support it. This is a critical change to note. Just to be clear:

> ***To get TTL flash on a D80 you must use the internal flash, an SB-400, an SB-600, an SB-800, or an SB-R200.***

Let me summarize a few things that are different between the three basic Nikon flash technologies before we go on. I realize that some of the terminology may be new to you, but by the end of the section on flash you should be fully up to speed; just come back to this chart then.

	Old Film TTL	***D-TTL***	***i-TTL***
Cameras Supporting	Virtually all film cameras after the FA	D1 series, D100, D2 series	D2 series, D40, D50, D70 series, **D80**, D200
Flash Units Supporting	All Speedlights since the SB-24	SB-28DX, SB-50DX, SB-80DX, SB-600, SB-800, SB-R200, D100 internal flash	SB-R200, SB-400, SB-600, SB-800, internal flash on D40, D50, D70, **D80**, D200
Preflash occurs	After mirror up, before shutter opens	After mirror up, before shutter opens	Before mirror up, before shutter opens
Flash Measurement occurs	Preflash and again during exposure	Preflash only	Preflash only
Flash Measured by	5-segment sensor in mirror box	5-segment sensor in mirror box	CCD in viewfinder
Multiple TTL flash supported?	Yes with cables or wireless with SU-4	No	Yes with cables or built-in wireless functions
TTL controlled wirelessly?	Yes, but all flashes fire at same level	No	Yes; flashes can even be grouped to fire at different levels (with SB-800, SU-800; or D70 series, **D80**, and D200 internal flash as Master)

A D80 using i-TTL is a good news, bad news situation: the good news is that this is arguably the most elaborate, user-controllable, and accurate TTL flash system Nikon—or perhaps anyone—has produced. The bad news is that you can only use the very latest flash units with it, which may mean purchasing new equipment.

Like all recent Nikon camera bodies, a flash-ready indicator is displayed in the D80 viewfinder when a flash—internal or

external—is fully charged and ready to fire. This same indicator blinks for three seconds *after* a photograph is taken to indicate that the flash fired at full power, which may indicate underexposure (of the subject). (On a D80, the indicator also blinks in low light if Custom Setting #23 is set.) Fortunately, with a D80 you can immediately review the image on the color LCD to determine if this "full power" warning actually meant underexposure.

More Hidden Flash "Gotchas"

One thing that catches a number of D80 users unaware is that the Program exposure mode limits apertures that can be used with flash based upon ISO value. And given the fast apertures of most pro lenses, you're quite likely to bump up against this limitation at some point:

Allowable Apertures in Program and Scene Exposure Modes [124]

ISO Value	*Range (internal flash)*	*Range (external flash)*
100	f/2.8 to f/32	f/4 to f/32
125	f/3.2 to f/32	f/4.5 to f/32
160	f/3.2 to f/32	f/4.5 to f/32
200	f/3.5 to f/32	f/5 to f/32
250	f/3.5 to f/32	f/5 to f/32
320	f/4 to f/32	f/5.6 to f/32
400	f/4 to f/32	f/5.6 to f/32
500	f/4.5 to f/32	f/6.3 to f/32
600	f/4.5 to f/32	f/6.3 to f/32
800	f/5 to f/32	f/7.1 to f/32
1000	f/5 to f/32	f/7.1 to f/32
1250	f/5.6 to f/32	f/8 to f/32
1600	f/5.6 to f/32	f/8 to f/32
H0.3	Not available	Not available
H0.7	Not available	Not available
H1.0	Not available	Not available

[124]Be wary of data in Nikon's manuals. For example, the chart on page 121 of the D80 English manual is very much incorrect *and* misleading (as are several others; but this one is particularly important to point out). It seems to imply (once you relate the heading to the data) to all flashes. It doesn't. It applies only to the external flash and it has incorrect values in it! My tables are created through empirical testing.

Note: If the camera is set to Close-up Scene exposure mode, the values for internal flash are set about one stop slower.

Yes, that table means what you think it does: if you set Program exposure mode using external flash, those fancy wide apertures of your expensive lenses won't ever be used.

Another issue to note with the D80 is that the focal lengths the Speedlight uses are geared towards 35mm film, not the D80's 1.5x field of view reduction. This means that you'll normally be lighting a wider angle than the D80 is taking in, wasting flash strength. Here's a handy table to use when shooting with a Speedlight flash:

D80 Safe Flash Head Focal Length Settings

Lens Focal Length	*Set Flash to*
14mm	20mm
17-18mm	24mm
20mm	28mm
24mm	35mm
35mm	50mm
50mm	70mm
60-70mm	85mm
>85mm	105mm*

**Assumes SB-800*

In other words, if you have a 20mm lens on the D80, manually zoom the flash head to the 28mm mark. The settings in the above table are the closest that guarantee full-frame coverage for the D80's reduced sensor size, and provide you the maximum flash power for that coverage, extending the distance at which you can shoot with flash.

Flash Modes

Like most Nikon 35mm film camera bodies, the actual method used to calculate flash exposure varies considerably depending upon camera settings, flash settings, and the lens being used. A full discussion of the intricacies of Nikon's flash system can be found in my *Nikon Digital Flash Guide*, but

what follows is a simple recap of what's available using a D80.

i-TTL Balanced Fill-Flash

(**TTL BL** on external flash LCD; no indicator for internal flash): this is the *default* flash mode for most camera settings. Requires use of a D, G, P, AF, AF-I, or AF-S lens (basically any lens that has what Nikon calls a CPU in it). The camera balances exposure information from the matrix meter with additional information from the lens (focal length, aperture, and distance at which the lens is focused for D and G type lenses) and from a series of nearly invisible pre-flashes, which the CCD in the D80's viewfinder analyzes. When set in this mode, the D80 normally attempts to balance the flash with the ambient light. Generally, less flash is produced in this mode than if you set the flash manually for the flash-to-subject distance.

Note that *no* measurement of the light produced by the flash is made by the D80 *during* the exposure, as is done on the 35mm film camera bodies; the amount of flash produced is completely determined at the end of the pre-flash measurements, which occur before the shutter opens. Thus, if lighting conditions change rapidly, the amount of flash produced may be incorrect. That happens rarely, but the lower power of the preflash does make the accuracy of the flash exposure calculations slightly more subject to error than the during-exposure re-measurement the film bodies do.

The more likely problem of preflash on the D80 is that it triggers "early blinkers." There's just enough time between the preflash and the actual flash that some fast-responding individuals will start to or already have blinked their eyes in response to the preflash by the time the actual flash goes

off [125]. That almost never happened with the old film TTL system.

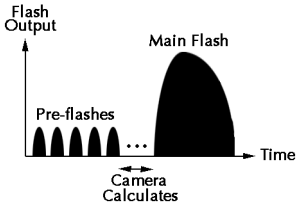
A few paragraphs back you'll note that I wrote that the D80 "normally attempts to balance the flash with the ambient light" when in Balanced Fill-Flash mode (**TTL BL**). That "normally" is an intentional qualifier that needs some discussion. Previous Nikon DSLRs tended to continue to try to balance ambient and subject light, even in dark conditions. The D80 has firmware changes that seem to recognize low light conditions and change the strategy of **TTL BL** (as does the D200). Unlike, for example, the D50, D70, or D100, the D80 and D200 seem to do a better job of lighting the subject independently of the background exposure when you're using flash. Thus, the old "background dim, subject dim" result that some earlier Nikon DSLRs produced seems to be partially gone. That removes one of my objections to using **TTL BL** as the default.

One other slight change that will only be of interest to seasoned Nikon flash users: there is no longer any indicator of the *type* of Balanced Fill-Flash that the camera performs if you use an older autofocus lens (the ones that didn't provide distance information to the camera). On some older Nikon bodies, subtle differences snuck into Balanced Fill-Flash levels, usually due to the metering system and lens being used, and this was indicated by different symbols on the flash LCD. With the i-TTL systems, those symbols no longer appear and Nikon doesn't try to explain any differences that may occur (other than an oblique reference to lenses without CPUs). As far as I can tell, there still are some subtle differences being made due to camera settings, but they are indeed very subtle and mostly ignorable.

Note: *Unlike the SB-24 and later flashes on film bodies, the D80 internal flash, SB-400, SB-600, SB-800, and SB-R200* always *fire pre-flashes in i-TTL modes, even if the flash head is set*

[125] Hint: use **FV Lock** to control when the preflash is done. See CSM #16 on page <418>.

to a bounce angle (Speedlights used on 35mm bodies cancel pre-flashes if the head is swiveled or angled at anything other than the normal position, relying only on the reflected flash measurement during exposure).



The pre-flash is usually a series of short pulses, with a regular pattern.

Standard TTL

*(***TTL*** on external flash LCD*)*: This flash mode is available with all autofocus lens types and AI-P lenses; the camera automatically chooses it if you select spot metering. Unlike the Balanced Fill-Flash mode, Standard TTL attempts only to ensure that the flash provides the correct exposure for what the camera thinks is the subject. In other words, the camera does not attempt to balance background exposure with subject exposure, as it does in the Balanced Fill-Flash TTL mode.

High-Speed TTL (TTL FP)

(**TTL BL FP** or **TTL FP** on external flash LCD; only available on SB-800 and internal flash): The D80 supports a variant for both Balanced Fill-Flash TTL and Standard TTL: FP. FP doesn't change the type of TTL being performed (Standard or Balanced), it only changes the allowable shutter speeds. If FP is active—and you make it so by setting Custom Setting #25—the upper shutter speed limit of 1/200 for flash is removed. That may seem like something you'd want to have available all the time (it is a setting I suggest as a default), but be careful. Shutter speeds above 1/200 cause the flash to produce its light differently. Instead of a single flash burst, the output is done in a series of very short, small bursts of flash, which reduces the overall output of the flash by a bit over two stops. If you use the TTL FP option, make sure to pay attention

to the range display on the external flash LCD whenever you shoot at faster than 1/200; the flash may not be able to cover the distance you're shooting at. For internal flash, consult the range table later in this eBook.

Summary of i-TTL Flash Modes

Flash LCD Displays	*Exposure Modes*	*Metering Modes*	*TTL Type Performed*
TTL BL	Program, Aperture, Shutter, Manual	Matrix, Center-weight	Balanced Fill Flash (shutter speed capped at 1/200)
TTL	Program, Aperture, Shutter, Manual	Spot*	Standard TTL (shutter speed capped at 1/200)
TTL BL FP	Program, Aperture, Shutter, Manual	Matrix, Center-weight	Balanced Fill Flash (no cap on shutter speed)
TTL FP	Program, Aperture, Shutter, Manual	Spot*	Standard TTL (no cap on shutter speed)

**Standard TTL mode is set automatically when you select this option.*

Note: TTL flash modes can also be changed (if the camera isn't set to Spot metering) by using the **Mode** *button on the external flash. In other words, if you see* **TTL BL** *on the flash LCD, pressing the* **Mode** *button selects* **TTL** *instead.*

Non-TTL Flash Modes

In the TTL flash modes just described, the *D80* performs all the calculations necessary to adjust the flash output level. When you press the shutter release, the camera tells the flash when to start firing and when to stop. The flash simply follows the camera's orders to turn on and off. Three remaining flash modes, Auto Aperture (**A**), Automatic (**A**), and Manual (**M**) flash, differ in that the *flash* performs much of the flash

exposure calculation and the camera body does not determine when the flash shuts off:

Auto Aperture ([A][A]*)*: Unique to digital camera bodies using external SB-28DX, SB-80DX, or SB-800 flashes. In Auto Aperture flash mode the Speedlight obtains the ISO value and aperture being used from the camera, as well as the signal to start the flash (i.e. "shutter's open, go ahead"). A sensor on the *front of the flash* is monitored, and when the amount of light that sensor sees reaches the level the flash calculates it needs, the flash stops firing. This mode is ***not*** available on the D80 except with the SB-800, and appears to be one of the simplifications Nikon made from the pro series cameras. That's unfortunate.

Automatic ([A]*)*: Available with all external flash units that have an Automatic flash mode. In Automatic flash mode, the Speedlight usually [126] sees only the signal to start the flash. You must transfer the aperture and ISO used on the camera by setting this manually on the flash. Again, a sensor on the *front of the flash* is monitored, and when the amount of light it sees reaches the level the flash calculates it needs (based upon aperture setting and ISO value), the flash stops firing. Besides the cumbersome limitation of transferring the aperture and ISO settings to the flash, the flash sensor doesn't see the same thing as the camera lens, which can result in errant flash levels.

Note: The classic "trouble case" for both Automatic and Auto Aperture flash modes is shooting through a doorway: the flash sensor sees light reflecting off the door frame and nearby walls, while the lens may be zoomed in to only see a subject in the next room, well beyond the doorway. If you choose to use Auto Aperture or Automatic flash mode, you need to always watch to make sure the flash sensor is seeing the same subject as the lens and is not blocked by cables or other objects.

[126] Most older Speedlights and third-party flashes do not communicate anything with the camera and only understand the "fire now" signal.

Manual (M): Available with any Speedlight that supports Manual flash modes, including the internal flash on the D80. In Manual flash mode, the Speedlight fires at a fixed output you select. It's up to you to perform the calculations to ensure that the proper amount of flash is produced. Many Speedlights have variable power levels, plus their output is also dependent upon what focal length the flash head is set for, thus doing manual flash calculations sometimes takes a bit of time, as well as consulting a Guide Number chart. On the other hand, a correctly made manual flash calculation should always provide exactly the right amount of flash on a subject. The general formula is:

Aperture = GN / Distance

or GN = Distance * Aperture

or Distance = GN / Aperture

Make sure that the GN you plug into those formulas is expressed in the same units as the Distance (feet or meters), and that you're using the correct GN for the focal length set on the Speedlight. Also, make sure that the GN you look up is for the ISO value set on the camera body (Nikon's flash manuals all use ISO 100 values; to convert them to ISO 200, multiply those values by 1.4; for ISO 400, multiply by 2).

Likewise, if you're using less than full power, make sure you're using the correct GN for the lower power. Most recent Speedlight models show a distance indicator on their LCD in this mode, though the limited "resolution" of this indicator means you can't totally rely upon it.

Flash modes can usually be set on the flash unit, too:

TTL	Only available on the SB-600, SB-800, and SB-R200. With one of these Speedlights mounted on the camera, press the **Mode** button on the back of the flash until **TTL BL** or **TTL** is displayed (see "Summary of TTL Flash Modes" on page <454>); if you're using an SB-R200, its mode is controlled by the Master flash controlling it. If Custom Setting #25 is set to allow it, **FP** may also appear to indicate that shutter speeds higher than 1/200 can be used, though flash power will be reduced.
Auto Aperture	Not available on the D80 except with the SB-800; press the **Mode** button on the back of the flash until **AA FP** or **AA** is displayed.
Automatic	Available on all Speedlights that support Automatic flash (SB-24 through SB-80DX, for instance). Move the Flash Mode switch on the Speedlight to **A** (or **AUTO**), or press the **Mode** button on the Speedlight until A is displayed on the flash unit's LCD. You may need to manually transfer the ISO setting and aperture to the flash.
Manual	Available on all Speedlights that support Manual flash. Move the Flash Mode switch on the Speedlight to **M** (or a specific power level, such as ½, ¼, 1/8, etc.), or press the **Mode** button on the Speedlight until M is displayed on the flash unit's LCD

(specific power levels are usually then set by pressing the **+** or **–** buttons on the flash). You'll need to manually transfer the ISO setting.

Setting Flash Options

Setting the exact flash options used is a bit confusing to Nikon newcomers, as some of them are only available with particular equipment, some settings are done on the camera, and some are done on the flash. Nikon also uses two similar terms, "flash sync mode[127]," which determines *when* the flash is fired, and "flash mode," which determines *how* the flash is fired and what component does the flash length calculations.

The D80 understands five flash sync options (again, Nikon calls them flash sync modes):

Front Curtain Sync

The flash fires when the shutter is first opened. Any shutter speed between 1/60 (or other value set by Custom Setting #24) and 1/200 second is allowed in Aperture-priority and Program exposure modes. Any shutter speed between 30 seconds and 1/200 is allowed in Shutter-priority and Manual exposure modes). This is the default setting for flash options on the D80 and is indicated by no flash icons appearing on the top LCD. (Notes: TTL FP and AA FP remove the faster shutter speed limit [1/200]. SB-24, SB-25, and SB-26 flash units should have their **Mode** switch set to **NORMAL**.)

[127]You'll note that I've chosen to call these items "options" rather than "modes." Nikon uses the term *mode* so frequently that it gets very confusing. For example, if I ask a student which flash mode they have set, they'll sometimes answer "Rear Sync." That's not the answer I was looking for. I'll try to be consistent and use "flash mode" only to refer to the technique by which flash exposure is calculated (TTL, Automatic, and Manual) and "flash options" to all the other flash settings that might alter how the flash behaves.

Slow Sync

icon on top LCD

The flash fires when the shutter is first opened and any shutter speed between 30 seconds and 1/200 second in all exposure modes. Light trails caused by subject movement in long exposures seem to be in front of the subject. (Notes: TTL FP and AA FP remove the faster shutter speed limit [1/200]. SB-24, SB-25, and SB-26 flash units should have their **Mode** switch set to **NORMAL**.)

Rear Sync

icon on top LCD

The flash fires just before the shutter is closed and any shutter speed between 30 seconds and 1/200 second is allowed in all exposure modes. Light trails caused by subject movement in long exposures seem to follow the subject, a more natural-looking effect than produced by slow sync. (Notes: TTL FP and AA FP remove the faster shutter speed limit [1/200]. SB-24, SB-25, and SB-26 flash units should have their **Mode** switch set to **REAR**.)

Redeye Reduction

icon on top LCD

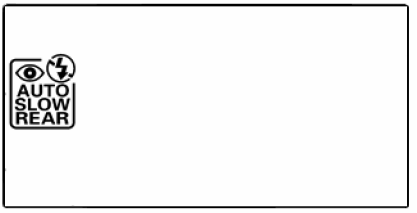
The external flash or the Redeye Reduction lamp (for internal flash) is fired one or more times prior to the actual picture (in order to cause the subject's pupils to close, reducing redeye). Otherwise, this option is the same as Front Curtain sync. Personally, I'd avoid this option, as it introduces huge shutter release lag, generally annoys subjects, and doesn't normally improve redeye characteristics enough to make a difference. (Notes: This option is only available with SB-26, SB-27, SB-28, SB-28DX, SB-50DX, SB-80DX, SB-400, SB-600, SB-800, and SB-R200 flash units. SB-24, SB-25, and SB-26 flash units should have their **Mode** switch set to **NORMAL**.)

Redeye Reduction with Slow Sync

icon on top LCD

The same as Redeye Reduction, except that longer shutter speeds are allowed in Aperture-priority and Program exposure modes. Personally, I'd again avoid this option, as it introduces huge shutter release lag, generally annoys subjects, and doesn't normally improve redeye characteristics. (Notes: This option is only available with SB-26, SB-27, SB-28, SB-28DX, SB-50DX, SB-80DX, SB-400, SB-600, SB-800, and SB-R200 flash units. The SB-26 should have its **Mode** switch set to **NORMAL**.)

To set all flash sync options: hold the Flash Options button down and rotate the Rear Command dial until the appropriate flash mode icon is displayed in the top LCD.

Top LCD: 

Note: The SB-24, SB-25, and SB-26 also have to be set to **NORMAL** *or* **REAR** *depending upon which flash sync option you're using on the camera.*

Since several settings intersect one another for these options, here's a table that summarizes the information just presented:

Flash Option Interactions

Option	*Exposure Mode*	*Allowable Shutter Speeds**
Front curtain	Program, Aperture	1/60 to 1/200 second
Front curtain	Shutter, Manual	30 seconds to 1/200 second
Slow sync	Any	30 seconds to 1/200 second
Rear sync	Any	30 seconds to 1/200 second

Note that the aperture range on the camera may further limit the range of shutter speeds that produce correct exposures. Also, if you've got* **TTL FP *or* **AA FP** *flash set, you may exceed the 1/200 value, but at the expense of flash power. Finally, if you've set Custom Setting #24, Slow Sync, or Rear Sync, the slowest shutter*

speed in Program and Aperture-priority exposure mode may be different.

Flash Exposure Compensation

Flash exposure compensation can be set on the external flash or on the D80 body. For the external flash, that usually involves pressing the flash unit's Direction pad in the direction of the + and – symbols while in a TTL flash mode. For the D80 body, that means holding down the Flash Options button and rotating the Front Command dial.

Flash exposure compensation isn't as straightforward as you might think:

- *Balanced Fill-Flash (TTL BL) gets in the way*. If the camera is set to use balanced fill-flash (the default), you aren't actually fully in control of the flash exposure compensation value used by the camera. Nikon's Balanced Fill-Flash modes preset unknown amounts of flash exposure compensation based upon scene brightness, scene contrast, and a host of other variables. The camera may decide to ignore what you set, and it may respond slightly differently if a slightly different exposure pattern presents itself to the matrix meter. Indeed, the classic beginner mistake is to try to use exposure compensation and flash exposure compensation to override the camera's automatic decisions. The more EV change you ask for, the more the camera is likely to fight you. ***Solution:*** Put the camera in Standard TTL mode if you want to set exposure and flash exposure compensations yourself.
- *You don't always get what you want.* Especially for positive (e.g. +1 EV) values, the flash may not be able to produce the value that you've asked for. Students ask me why I carry laminated field charts with GN values for my flashes. That's because it's the easiest way to figure out exactly what each flash is and isn't capable of. With 4 different flash units, as many as 10 zoom settings, and ISO values ranging from 100 to 1600 (on my D80), that's more GN and range possibilities than I can keep in my head.

- *Flash exposure compensation is cumulative*. Flash exposure compensation can be set on both the D80 body (using the Flash Options button and Front Command dial) or on an external flash (using the controls on the flash). Those compensations are cumulative! If you set -1.7 EV on the external flash and -1 EV on the D80 body, you'll get -2.7 EV flash exposure compensation. Thus, you need to be very careful about where you set flash exposure compensation. If the D80 is your only Nikon body then *always* set flash exposure compensation on the camera body. If you also use a Nikon DSLR that doesn't have an internal flash and always use external flash, then *always* set flash exposure compensation only on the external flash. The in-between cases are the ones that'll eventually catch you. Personally, I try to always use an external flash and always set my flash exposure compensation on the external flash. Whenever I have to set flash exposure compensation on the body (e.g. I didn't bring an external flash and am using the internal one on my D80), I always cancel whatever flash exposure compensation I set on the body immediately after using it.

Flash Features Available using a D80 with Speedlights

Model	TTL	A	M	AF	Slow	Rear	RF	RE	FP
Internal	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
SB-R200	**Yes**	**No**	**Yes**	**No**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
SB-400	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**No**
SB-800	**Yes**	**Yes[1]**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
SB-600	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
SB-80DX	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
SB-50DX	No	No	Yes	Yes	Yes	Yes	No	Yes	No
SB-30	No	Yes	Yes	No	Yes	Yes	No	No	No
SB-29/29s	No	No	Yes	Yes[3]	Yes	Yes	No	No	No
SB-28DX	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
SB-28	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
SB-27	No	Yes[2]	Yes	Yes	Yes	Yes	No	Yes	No
SB-26	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
SB-25	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
SB-24	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
SB-23	No	No	Yes	Yes	Yes	Yes	No	No	No
SB-22s	No	Yes	Yes	Yes	Yes	Yes	No	No	No
SB-22	No	Yes	Yes	Yes	Yes	Yes	No	No	No
SB-21B	No	Yes	Yes	No[3]	Yes	Yes	No	No	No

[1] *Auto Aperture supported*

[2] SB-27 needs to be set to "forced A" mode (see "Flash Troubleshooting" on page <503> for details)

[3] Realistically only usable with Micro-Nikkor lenses or with other lenses focused at close distances

A = automatic flash mode
AF = autofocus assist
FP = high-speed sync mode
M = manual flash mode
RE = red-eye reduction
RF = repeating flash
Rear = rear (second-curtain) sync
Slow = Slow sync
TTL = Through-the-lens metering

Note: Preferred Speedlights are highlighted in bold in the table. Speedlights not listed are not recommended for use on the D80.

*Tip: Flash is a very complex subject. It took me an entire book to fully describe Nikon Speedlight operations (*Nikon Flash Guide*, originally published by Silver Pixel Press; a new edition will appear soon under byThom Press). If you'd like to learn more about Nikon flash operation, may I humbly suggest you get a copy of my book?*

Controlled, Repeatable Flash Results

At my workshops the number one question I get concerns how to get repeatable results using flash, especially when you use flash for fill. Basically, this requires that you take control of the decisions that are being made instead of letting the camera make the decisions.

If you have the time, it always pays to turn off the automatic flash control and take charge of it yourself. The way I usually teach goes something like this:

1. Put the camera in Manual (M) exposure mode. When using flash, the aperture and shutter speed control the *background* (ambient light) exposure, flash tends to control the foreground, or *subject* exposure. In Manual exposure mode you are guaranteed to be completely in control of the background exposure.
2. If you want a full exposure on the background, use the exposure meter to set a value of **0** on the Manual Exposure Metering bar. If you want the background slightly darker than the foreground subject lit by flash, set an underexposure of the background of -0.3 to -1 stop. (It's also possible to set the background brighter than the foreground, but that is rarely something you'd want to do, and your subject would have to be in a darker light, or it, too, will end up overexposed.)
3. Turn the flash ON [128].
4. Set the flash to Standard TTL mode (on the D80, this is automatic if you're in spot metering; otherwise you'll have to press the **Mode** button on the external Speedlight to cancel the **BL** after the **TTL** symbol on the flash LCD). (Alternatively, if you want to be very precise, you can use Manual flash mode, but this usually involves more

[128]You can power the flash before Step 1, but I intentionally have you turn it ON here because, if you get in the habit of doing this, if you later switch from Manual to Program or Aperture-priority modes, you'll immediately notice if the camera changes your exposure (at least you *should*).

calculation or button pressing than you may have time for.)

If you want the flash to fully light the subject, start with a flash exposure compensation value of between -1 and 0 EV. You need to experiment a bit to see what looks good to you, and if the subject is white or black, you may need to compensate for that (just as with the main exposure meter, the flash meter in the D80 tries to make the "average" exposure middle gray. Also, in bright situations, you'd tend to use more flash compensation, in dark situations, less.

If you want the flash to provide fill light on the subject, start with a flash exposure compensation value of about -1 to –1.7 EV for people, from -1.7 to –2.3 EV for objects in shadow. Again, you need to experiment to find the value that looks right to you.

The background exposure you set in Step 2 and the subject exposure you set in Step 4 should be consistent for average toned subjects. In other words, once you determine the compensation values you like, they should remain relatively consistent in other situations, just as long as the subject or background isn't all white or all black (i.e. for mid-tone values).

For fill flash in general, the advice I've been giving for the last five years still stands:

- *Put the camera in Aperture-priority exposure mode*. Why? Because Program exposure mode restricts apertures you can use, Aperture-priority doesn't. (If you're shooting sports with the D80, Shutter-priority is another choice; the point is to get out of Program exposure mode.)
- *Set the Slow Sync flash option on the camera*. Why? Because this removes the 1/60 lower shutter speed limit in Aperture-priority exposure mode. On the D80 you have an alternative: use Custom Setting #24 to set the lower

shutter speed limit to what you can hand hold. On my D80, I've set 1/15 and don't normally use Slow Sync.

- *Put the flash in Standard TTL mode*. Why? Because we want to control the exact amount of flash used. Normally, the camera makes unknown adjustments when it is in the more advanced balanced fill-flash mode (**TTL BL**), and these adjustments aren't repeatable.
- *Dial in Flash Exposure Compensation*. Again, -1 EV for people and between -1.7 for objects in shadow are good starting points. Why? We're using flash to fill in light, not to produce the main light for our subject. I have noticed that I tend to use slightly lower settings than this on the D80 (e.g. -1.3 for people and –2 for things) than I do on the D100, though I'm unsure why this is true (probably a difference in D-TTL versus i-TTL).

Every time I post these recommendations on a Web forum, I get a lot of grief from other posters. Specifically:

- *Why do Program and Scene exposure modes make aperture restrictions with flash?* Apparently Nikon made design decisions that had to do with the guaranteed "reach" of the flash in the all-automatic modes. All I know is that if you have an f/2.8 or faster lens and you're shooting with flash in Program or Scene exposure mode, you've wasted your money on the fast lens. At some ISO values with external flash, that restriction hits f/5.6!
- *Doesn't Slow Sync give me shutter speeds that will show camera shake?* Perhaps. But if you're in light so dim that you can't get a 1/60 second shutter speed, you're probably not using the flash for *fill*. You probably want the flash to fully light the subject, and when you dial up the flash to provide full light, the flash *duration* becomes the effective shutter speed (the longest duration of a Nikon flash is 1/830 of a second; the SB-800 is 1/1050). You may have to let the background go dark to get "perfectly sharp" photos, but I've taken sharp handheld shots this way with exposures as much as two seconds using a 200mm focal length. Note that you can't have much subject motion if the background exposure is close to the subject exposure.

- *Why do I have to use Standard TTL?* Because Nikon's Balanced Fill-Flash mode uses internal variants of both Flash Exposure Compensation *and* Exposure Compensation to "balance" the ambient (background) and subject lighting in bright light. These compensations are unknown and vary based upon scene contrast, scene brightness, focus distance, and more. In dark light, the camera alters its strategy a bit and treats the flash as the primary source of light for your subject, though it still may apply slight exposure compensations based upon what the meter sees. Thus, **TTL BL** produces results that are not always repeatable. You may take pictures in one set of lighting that are good, in another, bad. Slight changes in camera position sometimes produce slight differences in exposure when you don't expect them to. That's why I tell you to take control of what the flash is doing and dial in your own compensation.

Third Party Flash Units

The i-TTL flash units required by the D80 to perform TTL mean you are restricted to the SB-600, SB-800, and SB-R200 if you want to purchase an external flash and retain the most available capabilities.

It took over two years after D-TTL came out for any third party flashes to support it, so it may be awhile before we see any desirable i-TTL units from other companies. Metz makes one flash that can operate with i-TTL (though it's secondary flash head—the reason why many gravitate to Metz—is incompatible). Sigma's latest flashes are also i-TTL compatible, though I've had inconsistent results with them.

But even if you want to use Automatic flash mode you'll probably find many third party flashes lacking. That's because you'll often have to manually transfer ISO and aperture settings.

At present, I don't recommend third party flashes with the D80. There are just too many caveats. If you want an external flash for the D80, the SB-600 and the SB-800 are currently the

best choices. First, they'll give you significantly more power. Second, they will work wirelessly with the internal flash. And finally, they can do TTL above 1/200 (**TTL FP**), which is where that extra power really comes into play.

Studio Flash

The D80 can be connected to studio lighting by connecting a standard PC Sync cable an optional AS-15 connector mounted in the hot shoe of the camera. Note that the standard ISO hot shoe on the camera should be limited to voltages of about 24 volts or less and some external lighting units can put as much as 200 volts on the pins. To play it safe, you can use an isolation connection, such as the Wien Peanut.

The Rear Sync option is only available using Speedlight units in the hot shoe, by the way.

D80 Internal Flash

The D80 has a very flexible built-in, low-power Speedlight. This internal flash is never automatically popped up and used *unless* you're in one of the Scene exposure modes. For the Program, Aperture-priority, Shutter-priority, and Manual exposure modes you manually control when it is used by popping it up into position (press the Flash Release button). If the flash is up, the flash fires [129]. If the flash is down, the flash doesn't fire. So, if you don't want flash, just push the flash head down so it locks into the down position.

The internal Speedlight doesn't zoom the flash head, allow bounce, or many of the other fancy features of the external Speedlight models, but it does provide adequate illumination for many situations you'll encounter, and has a couple of nifty tricks you might not have expected. Coverage is good to about an 18mm lens, assuming that the lens is small enough and doesn't block the light from the flash. There's a tiny bit of

[129] Unless you've programmed the **FUNC** button to **Flash off** and are holding it down.

corner falloff at 18mm, but not enough to worry about for most situations.

When you use the internal Speedlight, you need to be aware that the flash needs some time to recharge between flashes. Nikon doesn't state a recycling time specification, but generally, it's only a few seconds (1 or 2 seconds has been my observation, depending upon whether the flash fired at partial power or full power). If you attempt to take another picture using flash before the recharging has completed, the flash may not have enough power to correctly illuminate your picture.

I said that the internal flash is low power. You may wonder what that means. The GN at ISO 100 for the internal Speedlight is 42 (13m). That compares to a GN of at least 62 (19m) on an SB-800 at the same 18mm coverage area (and the SB-800 can provide even more light with longer lenses). What's that mean for photographic situations? For a subject at 10 feet, the internal Speedlight would require ~f/4, while the SB-800 would require f/6.3. That's a difference of more than one stop. (All GNs in this paragraph are stated at ISO 100.)

In practical terms, here's what the internal flash is capable of:

ISO 100	200	400	800	1600	Range in Ft	Range in M
f/1.4	f/2	f/2.8	f/4	f/5.6	3'3" – 30'2"	1.0 – 9.2m
f/2	f/2.8	f/4	f/5.6	f/8	2'4" – 21'4"	0.7 – 6.5m
f/2.8	f/4	f/5.6	f/8	f/11	2' – 15'1"	0.6 – 4.6m
f/5.6	f/5.6	f/8	f/11	f/16	2' – 10'6"	0.6 – 3.2m
f/8	f/8	f/11	f/16	f/22	2' - 7'7"	0.6 – 2.3m
f/11	f/11	f/16	f/22	f/32	2' - 5'3'	0.6 - 1.6m
f/16	f/16	f/22	f/32	f/45	2' - 3'7"	0.6 – 1.1m
f/22	f/22	f/32	f/45	f/64	2' - 2'7"	0.6 – 0.8m

There are a few things you should note about the above table:

- *The overall range is quite limited.* Assuming that you have fast enough apertures, Nikon's stated numbers give you maximum range of 3'3" to 30'2" (1 – 9.2m). If you shoot in Program or one of the Scene exposure modes, that

range is restricted further (red numbers in table aren't reachable). And on most Nikkor lenses, you can't set the smallest apertures (blue numbers in table). ***To use that f/1.4 or f/2 lens with flash and maximize your range, you have to get out of Program or Scene exposure modes.***

- *The aperture you use determines what range you'll have*. If you set f/4 at ISO 200, for example, you cannot get the maximum range the flash is capable of. ***If you want to guarantee maximum range at f/4, you'll need to be at ISO 800 or 1600. At f/2.8 you can use ISO 400 and up.***
- *There's a minimum flash distance, regardless of aperture*. As with all Nikon bodies and flashes, shooting at distances shorter than 2' (0.6m) shouldn't normally be done, as the camera won't always calculate flash exposure correctly. Moreover, with the internal flash, there's an issue of whether the flash is pointed correctly for close up work. At longer distances, some lenses and lens hoods interfere with the internal flash. A few of these are listed in the D80 manual, but that list is by no means comprehensive. If you're interested in whether a combination will work or not, take a picture of a plain white wall in an otherwise dark room and examine the results to see if any shadow pattern appears (usually a crescent shadow at the bottom if the lens is blocking the light). ***The minimum distance you can use flash at is usually determined by whether your lens blocks the light from the flash.***

The internal flash can be used in TTL modes, Repeating flash, or Manual flash mode (see "Custom Setting #22, Flash Mode for Internal Flash" on page <429> for details on how to set the mode). It can also be used to provide wireless control of i-TTL flashes (see "Wireless Flash" on page <476>).

Internal Flash Basics

I've covered some of the internal flash use already, but to be consistent with the *Nikon Digital Flash Guide* and to elaborate on some of the deeper features of the internal flash unit, I'm going to provide a step-by-step section, just as I do with the common external flashes in the next section.

To Set TTL on the Internal Flash

1. Activate the flash by popping it up (press the Flash Release button). *This step happens automatically in most Scene exposure modes (and some Scene exposure modes don't allow use of flash).*
2. If you haven't already done so, use Custom Setting #22 (Flash Mode for Internal Flash, see page <429>) to set **TTL**.
3. Select the *type* of TTL to be performed. Basically, you only have one choice: whether to cancel the Balanced Fill-Flash mode (you do so for the internal flash by setting spot metering). I generally recommend that you not use Balanced Fill Flash, though it works better on the D80 than on many previous Nikon bodies.
4. Set the camera to Single Servo AF; flash only operates when the camera achieves focus; this step isn't technically required, but I like to tell people to use it as a reminder that focus has to be achieved for flash to operate.
5. Set the camera's exposure mode, if you haven't already. In Aperture-priority (A), Shutter-priority (S), and Manual (M) exposure modes, make any necessary aperture or shutter speed selections.

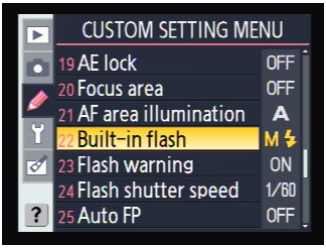
Note: In Program exposure mode you can usually override the camera's selection of aperture and shutter speed combinations by turning the camera's Rear Command dial (when the camera is active). But note that the maximum aperture you can use is restricted in Program exposure mode (the actual value depends upon ISO setting; see "Allowable Apertures in Program Mode" on page <449>.

6. You're ready to shoot.

To Set Manual Flash

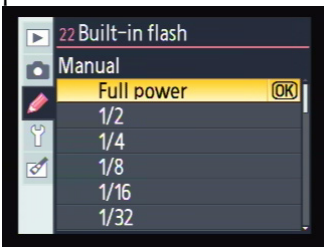
1. Press the **MENU** button to show the menu system.
    a. Use the Direction pad to navigate to the Custom Settings tab. Press the ▸ key or the **OK** button to enter the Custom Settings menu.

b. Use the Direction pad to navigate to Custom Setting #22. Press the ▸ key or the **OK** button to enter the Flash Mode setting.



c. Use the Direction pad to navigate to **Manual** flash mode. Press the ▸ key or the **OK** button to enter the Manual flash mode settings.

d. Use the Direction pad to navigate to the Manual flash power you want to set. Press the ▸ key or the **OK** button to select the flash power to be used.



2. Activate the flash by popping it up (press the Flash Release button).

3. Set the camera to Single Servo AF; flash only operates when the camera achieves focus; this step isn't technically required, but I like to tell people to use it as a reminder that focus has to be achieved for flash to operate).

4. Focus on your subject by pressing lightly on the shutter release. Note the distance on the scale on the lens.
5. Aperture = GN / Distance. Work the calculation and set the correct aperture. (Determine the GN by looking at the tables, below).
6. Set the D80 to the exposure mode you wish to use, and set your aperture and shutter speed, as usual. Just make sure that the aperture you set matches the one you just calculated in Step 5!

Internal Flash Guide Numbers (Feet)

Output Level	ISO 100	200	400	800	1600
Full Power	42	59	82	115	161
1/2 Power	30	42	59	82	115
1/4 Power	21	30	42	59	83
1/8 Power	15	21	30	42	59
1/16 Power	11	15	21	30	42
1/32 Power	7.8	11	14	21	30
1/64 Power	5.6	7.8	11	14	21
1/128 Power	4	5.6	7.8	11	14

Internal Flash Guide Numbers (Meters)

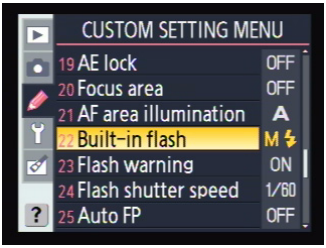
Output Level	ISO 100	200	400	800	1600
Full Power	13	18	26	36	50
1/2 Power	9.3	13	18	26	36
1/4 Power	6.6	9.3	13	18	26
1/8 Power	4.7	6.6	9.3	13	18
1/16 Power	3.4	4.7	6.6	9.3	13
1/32 Power	2.4	3.4	4.7	6.6	9.3
1/64 Power	1.7	2.4	3.4	4.7	6.6
1/128 Power	1.2	1.7	2.4	3.4	4.7

Note: All numbers above 10 rounded to the nearest digit; all numbers below that rounded to the nearest tenth.

To Set Repeating Flash

1. Press the **MENU** button to show the menu system.
    a. Use the Direction pad to navigate to the Custom Settings tab. Press the ▸ key or the **OK** button to enter the Custom Settings menu.

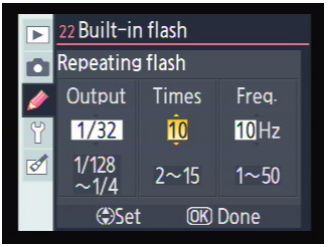
b. Use the Direction pad to navigate to Custom Setting #22. Press the ▸ key or the **OK** button to enter the Flash Mode setting.



c. Use the Direction pad to navigate to **Repeating flash** mode. Press the ▸ key or the **OK** button to enter the Repeating Flash mode settings.

d. Use the ▴ and ▾ keys on the Direction pad to choose the Manual flash power you desire. Only powers of 1/4 to 1/128 are allowed. Press the ▸ key to select the flash power to be used.

e. Use the ▴ and ▾ keys on the Direction pad to set the number of flash repeats you desire. Only 2 to 35 repeats are allowed (number depends upon flash power and frequency; higher flash powers have less flexibility in the number of repeats allowed; see table below). Press the ▸ key to select the repeats to be used.



1/4 power: 2 repeats maximum
1/8 power: 2 to 5 repeats
1/16 power: 2 to 10 repeats
1/32 power: 2 to 10, or 15 repeats
1/64 power: 2 to 10, 15, 20, or 25 repeats
1/128 power: 2 to 10, 15, 20, 25, 30, or 35 repeats

f. Use the ▲ and ▼ keys on the Direction pad to set the frequency of repeats you desire. Only frequencies of 1 to 50 times per second are allowed. Frequency should be higher than the number of repeats you set in Step 1f. Press the ▶ key to set the flash frequency you've indicated.

Note: *As described in the Custom Settings section (see page <429>), getting the right Frequency and Times values for Repeating Flash takes calculation. Start by first establishing a shutter speed you're going to use. Let's say your shutter speed is 1/2. Next, determine the frequency (how many flashes will be fired a second; Step 1f). A frequency of 10Hz means 10 times a second, so we need to divide the lower value of our shutter speed (2) into this, which tells us that we could have as many as 5 flashes while the shutter is open, which we set in our repeats value (Step 1e in the above; as you can see from the steps in setting procedure, Nikon got things backwards—we'd really want to perform Step 1f first, not Step 1e).*

2. Activate the flash by popping it up (press the Flash Release button).
3. Set the camera to Single Servo AF; flash only operates when the camera achieves focus; this step isn't technically required, but I like to tell people to use it as a reminder that focus has to be achieved for flash to operate).
4. Focus on your subject by pressing lightly on the shutter release. Note the distance on the scale on the lens.
5. Select an exposure mode. Typically Shutter priority or Manual exposure modes work best, as we're constrained by shutter speed due to our calculations in Step 1.
6. Set your shutter speed to the one you used in calculating the repeating flash effect (Step 1).
7. Set your aperture based upon calculating Aperture = GN / Distance. Determine the GN by looking at the tables in the Manual flash section, above. You know the distance from Step 4. If the aperture you calculate here can't be obtained, you'll need to go back and reset the manual flash power (Step 1d). If you can set the calculated aperture on your lens, do so and you're ready to shoot.

Wireless Flash

The big trick in the D80 internal flash arsenal is its ability to completely control a multiple wireless flash setup. Specifically, the D80's internal flash is a "Commander" and the other external flashes are "Remotes."

The way this works is that the Commander (internal flash) sends queries and instructions to each set of Remotes (external flashes) by using special preflash sequences. Only i-TTL capable flashes can be used for wireless work, which means SB-600, SB-800, or SB-R200 flashes must be used for Remotes.

For the wireless flash system to work, the remote flash units need to be able to see the light output of the D80's internal flash, and the D80 needs to be able to see the light output of the remote flashes.

You're probably wondering about these preflash queries and instructions. Let's say I have the full set of two Remotes in addition to my D80 internal flash (Commander). The preflash sequence that occurs when you press the shutter release now looks something like this:

Commander:	Remote Group A fire a preflash
Remote Group A:	Preflash fires
Commander:	Remote Group B fire a preflash
Remote Group B:	Preflash fires
Commander:	I'm firing a preflash
Commander:	Preflash fires
[Camera calculates exposure]	
Commander:	Remote Group A should fire at Level X
Commander:	Remote Group B should fire at Level Y
Commander:	Fire your flash in x milliseconds
[Camera mirror moves up, shutter opens]	
All flashes:	All flashes fire at calculated levels

Believe it or not, it's a *lot* more complex than that simplification. All the Flash Options, like Rear Sync, still come into play, which means that the Commander has to do a lot more instructing than just ask for a preflash and a TTL fire level.

Incredibly, all this communicating happens very quickly. If you're not watching specifically for it, you can't see the sequence of communication. On the other hand, you will almost surely note that there is more lag in the shutter release and that the preflash sequence seems longer. It is, and that can trigger fast blinkers [130].

[130]The solution for that is the same as I'll outline a little later in this section for SU-4 type wireless: use FV Lock. FV Lock removes the preflash sequence from the shutter release, moving it instead to the **FUNC** button. Thus, you set flash exposure by pressing **FUNC**. Then you wait to press the shutter release for the right moment of action (or inaction, depending upon your subject ;~). You only have to press **FUNC** and do another preflash sequence if lighting conditions change.

Since the actual communicating is done via the near IR energy in the light each flash produces, there are limitations on both the distance and the environment where wireless flash will work. Outdoors has more ambient near IR and fewer reflections, so distance is usually restricted and there usually has to be direct line-of-sight between camera and remote flash units. Because of bounces off walls and ceilings, wireless flash is a bit more flexible indoors—you sometimes can hide a remote flash out of line-of-site of the camera because its light reflects well enough for the camera to still see.

The jargon starts to get a little confusing, as Nikon uses different names at different places in its documentation. For example, Commander mode and Master flash get a little confusing if you read multiple Nikon manuals. I'll try to stay a little more consistent.

The D80 can control up to two groups of Remotes. Indeed, Nikon uses the label **Groups** instead of the Remotes name that I've been using. Each remote group can have multiple flashes in it, though Nikon doesn't recommend more than three flashes in a remote group, and I don't recommend that you use multiple flashes in a remote group unless they're all trying to light the same thing and you need more power than a single flash would provide. That's because the more flashes you set up, the more likely it becomes that one isn't seen in the preflash sequence.

But for a three-flash setup (the camera's internal plus two remotes), the D80's wireless abilities are excellent, and all that you need. (If you need more than two remote groups, you need to substitute an SU-800 or SB-800 on the D80 as the Commander instead of the internal flash. But that's a subject for another book…)

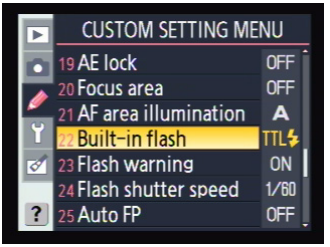
Here's how to set up a three flash wireless shoot (I'll use one SB-600 and one SB-800 as the Remotes so that we step through the remote setup for each; you could instead have two of either or even SB-R200's):

1. Use CSM #22 to set **Commander Mode**.

a. Press the **MENU** button to show the menu system.

b. Use the Direction pad to navigate to the Custom Settings tab. Press the ▸ key or the **OK** button to enter the Custom Settings menu.

c. Use the Direction pad to navigate to Custom Setting #22. Press the ▸ key or the **OK** button to enter the Flash Mode setting.



d. Use the Direction pad to navigate to **Commander mode**. Press the ▸ key to enter the Commander Mode settings.

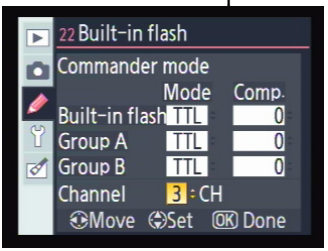
e. You must set two things for each participating flash: the flash mode it'll use (**Mode**) and the flash output level (**Comp.** [131]). You navigate to fill-in-boxes with the ◂ and ▸ keys on the Direction pad; you set value in the boxes with the ▾ and ▴ keys on the Direction pad.

[131] I guess **Comp.** is supposed to stand for "compensation." But that's not quite accurate. If a flash is set to **TTL**, **Comp.** sets *flash* exposure compensation for that flash. If a flash is instead set to **M** (Manual), **Comp.** sets the power level (1/1 = full, 1/2 = half, etc.) for that flash.

i. For each flash (internal, Group A, Group B), set the flash mode. You can set **TTL**, **AA** (not for internal flash), **M**, or **--**. The last item, **--**, means that this flash or Group will not participate in the exposure.

ii. For each flash (internal, Group A, Group B), set the flash exposure compensation (for TTL) or power output level (for Manual flash).

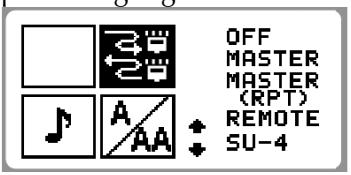
f. Finally, use the ▸ key to navigate to **Channel** and then use the keys to set one of the four channels that the preflash sequence uses.



2. Let's move on to our first remote flash, which for illustration purposes will be an SB-800.

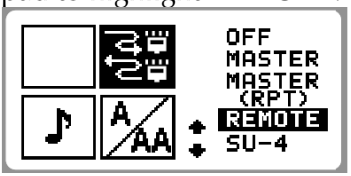
a. Press the **SEL** button on the SB-800 for more than two seconds to get to the Custom Settings for the flash.

b. Use the ▼ and ▲ keys on the SB-800 Direction pad to highlight the wireless flash icon.

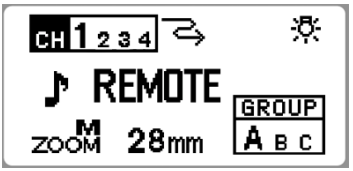


c. Press the **SEL** button to get to the options for wireless flash.

d. Use the ▼ and ▲ keys on the SB-800 Direction pad to highlight **REMOTE**.



e. Hold the **SEL** button down for two seconds to leave Custom Settings on the flash. The SB-800 should now be set for remote use:



f. To set the Channel, press[132] the **SEL** button until **CH** is highlighted (inverted white letters on black), then use the ▼ and ▲ keys on the SB-800 Direction pad until the channel number you set in Step 1f is highlighted.

[132]I'm specific in word use. This is not the "hold down" that you used to get to the Custom Settings for the flash. Instead, when I say press, I mean a quick jab of the button. It may take multiple jabs to get to the right item, which is why I say "press…until."

g. To set the Group, press the **SEL** button until **GROUP** is highlighted (inverted white letters on black), then use the ▼ and ▲ keys on the SB-800 Direction pad until the first Group letter you set in Step 1eii is highlighted.

h. Orient the SB-800 so that its infrared receiver is looking towards the D80's internal flash (note that you can rotate the flash head to fix the orientation, if necessary).

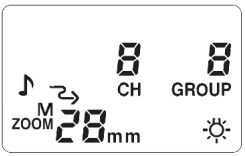
3. Now to our final flash, this time an SB-600:

a. Simultaneously hold down the **Zoom** and **-** buttons on the SB-600 for more than two seconds to get to the Custom Settings for the flash.

b. Use the ▼ and ▲ keys on the SB-600 Direction pad to highlight the wireless flash icon.

c. Press the **Zoom** button until On shows above the wireless icon.

d. Press the **On/Off** button briefly to leave Custom Settings. The SB-600 should be set for remote use:



Actual channel and group will vary—you'll set them below.

e. To set the Channel, press[133] the SB-600 **Mode** button until the number above **CH** is blinking, then use the ▼ and ▲ keys on the SB-600 Direction pad until the channel number you set in Step 1f is highlighted.

f. To set the Group, press the SB-600 **Mode** button again until the number above **GROUP** is blinking, then use the ▼ and ▲ keys on the SB-600 Direction pad until the first Group letter you set in Step 1eii is highlighted.

g. Orient the SB-600 so that its infrared receiver is looking towards the D80's internal flash (note that you can rotate the flash head to fix the orientation, if necessary).

4. Activate the internal flash on the D80 by popping it up. (Press the Flash Release button.)

5. Set the camera to Single Servo AF; this step isn't technically required, but I like to tell people to use it as a reminder that focus has to be achieved for flash to operate.

6. Set the camera's exposure mode, if you haven't already. In Aperture-priority (A), Shutter-priority (S), and Manual (M) exposure modes, make any necessary aperture or shutter speed selections.

Note: In Program exposure mode you can usually override the camera's selection of aperture and shutter speed combinations by turning the camera's Rear Command dial (when the camera is active). But note that the maximum aperture you can use is restricted in Program exposure mode (the actual value depends upon ISO setting; see "Allowable Apertures in Program Mode" on page <449>.

You're ready to shoot.

[133] I'm specific in word use. This is not the "hold down" that you used to get to the Custom Settings for the flash. Instead, when I say press, I mean a quick jab of the button. It may take multiple jabs to get to the right item, which is why I say "press…until."

Nikon includes a drawing showing where remote flashes need to be positioned relative to the D80. I've actually found their suggestions to be relatively conservative, especially in low light, where the infrared component of the preflash is easily seen by the remote flashes. In general, here are a few positioning guidelines:

- In low light, the remote flash sensor doesn't always have to have a direct line of sight to the camera's internal flash. I've successfully hidden a remote flash behind the subject (to light the background or provide rim light). This works better over short distances, though.
- You should be able to achieve Nikon's stated 33 feet (10m) distance (within a 60° angle) in most situations, but beware of situations where there is a great deal of infrared energy present (some incandescent lighting produces infrared)—you may have to give up some distance where other infrared sources are present, as they'll overwhelm the sensor and it won't see the faint output of the internal flash.
- I've been able to achieve remote triggers at better than 120° angles, but only at close distances (10 feet [3m]).
- Triggering the remote flashes is only part of the equation. In general, remote flashes doing TTL need to be within 30° of the camera-subject axis. In other words, the angle formed by the flash/subject/camera needs to be 30° or less. Why? Because when subjects are lit from the side, the camera—which after all is doing the flash calculations—doesn't see the full reflection of the flash's output and may adjust its exposure incorrectly.

Finally, there's yet one more wireless trick that isn't described in the Nikon manuals that every D80 user should know: Flash Lock (called **FV Lock** by Nikon in the menu system; FV stands for Flash Value). This answers the problem of getting the internal flash to trigger a multiple wireless TTL set up

when you *don't* have i-TTL flashes as remotes [134]. For example, Nikon sells a wireless flash accessory called the SU-4, and some Nikon flash models can emulate that wireless function without being connected to an SU-4 (for example, the older SB-26). The critical element of the SU-4 circuitry is this: it triggers the flash connected to it to fire when it sees another flash fire, and it shuts down its connected flash when it sees the other flash stop firing. Since the D80's internal flash is already set to the right flash exposure via FV Lock, the flashes connected to the SU-4's just do the same exact thing.

As long as the flashes aren't all throwing their light on the same spot (e.g., one is used for filling light on one side of the face while another is used for the background while the internal flash is used for key light), this trick works well. But even if they are all firing their light on the same spot, you can easily control this by simply dialing down the internal flash with flash exposure compensation—every other flash will respond in kind, so it's usually pretty easy to dial in the right compensation.

Here's the trick in more detail:

1. Set the Custom Setting #16 on the D80 to **FV Lock**.
2. Set Custom Setting #22 to **TTL** (if it isn't already set to that).
3. Pop up the internal flash (press the Flash Release button to do this).
4. *Before* turning on your remote flashes, fire off a test exposure by pressing the **FUNC** button on the camera (the internal flash should fire). Get your main flash setting correct before proceeding.
5. Turn the remote flash units on. They all either need to be connected to an SU-4 or have a built-in SU-4 type of wireless mode selected.

[134]Okay, it's not perfectly TTL, as the other flashes aren't considered in the exposure setting, but with a little trial and error, it effectively works like TTL.

6. Take your picture. All the flashes should participate in the exposure.
7. Since the remote flash units may be more powerful than the internal flash, you may have to adjust the position of the external flashes to be further from the subject (or use their diffusion domes to limit their power). When I'm feeling especially daring and creative, I actually set my exposure in Step #4 to underexposure and then *try* to get the remote Speedlights to fire a little hotter than the internal flash, but this is a big trial and error process you'll just have to experiment with yourself.

External Flash Models for the D80

SB-600

The SB-600 is one of three external Speedlights that can provide TTL flash with the D80. The SB-600 is similar to the SB-800, but with fewer features and lower power ratings. The SB-600 was announced with the D70 and arrived in stores in spring 2004.

Specifications

GN:	138 (ft), 42 (m) (at 35mm head position and ISO 200)
Weight:	10.6 oz. (300g) (w/o batteries)
Size:	4.9" (123.5mm) tall x 2.7" (68mm) wide x 3.5" (90mm) deep
Power:	four AA batteries
Recycle Time:	3.5 seconds minimum (full discharge)
# of Flashes:	~200 at full manual
Flash Duration:	1/900 to 1/25000
Coverage:	(120 degrees horizontal, 110 degrees vertical) 14mm lens; also supports 24mm, 28mm, 35mm, 50mm, 70mm, and 85mm coverage
Case:	SS-600 included
Key Features:	TTL flash control on the D80; Full power TTL, seven power level manual settings. LCD panel shows settings. Rear curtain sync. Red-eye reduction. The SB-600 can synchronize with up to nine additional flash units, in

groups of three controlled by one SB-800 master flash. Head tilts from –7 degrees below horizontal up to 90 degrees above horizontal, and rotates -270 degrees to plus 180 degrees clockwise. Built-in diffuser card. Stand included. Automatic or Manual wireless remote firing possible. Wide angle autofocus assist light.

To Set TTL Flash

1. Activate the flash. If it's already in Standby, a partial press of the shutter release activates it; otherwise, press the power (ON/OFF) button on the SB-600 to turn the flash ON.
2. Select the type of TTL to be performed. Basically, you only have one choice: whether to cancel the "balanced fill-flash" mode (you do so by pressing the **Mode** button on the flash until only the **TTL** indicator appears; if **TTL BL** appears, the camera is in a Balanced Fill-Flash mode; see "Summary of i-TTL Flash Modes," on page <454>).

Note: When the D80 is set for spot metering, Standard TTL is set automatically.

3. Set the camera to Single Servo AF (flash only operates when the camera achieves focus; this isn't technically required, but I like to tell people to use it as a reminder that focus has to be achieved for flash to operate).
4. Set the camera's exposure mode, if you haven't already. In Aperture-priority (A), Shutter-priority (S), and Manual (M) exposure modes, make any necessary aperture or shutter speed selections.

Note: In Program exposure mode you can usually override the camera's selection of aperture and shutter speed combinations by turning the D80's Rear Command dial (when the camera is active). But note that the maximum aperture you can use is restricted in Program exposure mode (the actual value depends upon ISO setting; see "Allowable Apertures in Program Mode," on page <449>.

Note: The D80 and SB-600 may warn you of several possible errors when you partially press the shutter release to verify settings:
- The lens must be set on its minimum aperture, or else the error message FEE *appears in the viewfinder.*
- Any H *visible in the viewfinder indicates that overexposure (of the background exposure) is likely.*
- The shutter speed will be automatically reset to 1/200 if you selected a faster shutter speed in Shutter (S) or Manual (M) exposure mode. (If FP is set, however, the camera will use any shutter speed.)
- In Manual (M) exposure mode, under and overexposure is indicated solely by the analog exposure display. If the exposure bar goes to either side of the 0 *point, the ambient-only lighting exposure will not be correct.*

5. Focus on your subject by pressing lightly on the shutter release. Confirm that the subject is within flash distance. Unfortunately, the SB-600 does not have a distance scale on it, so you'll have to either carry one of the charts duplicated below or memorize what distance it can reach at each zoom setting. Assuming you've confirmed the distance, you're ready to shoot.

SB-600 Usable Apertures and Flash Range in TTL mode (Feet)

ISO100	200	400	800	1600	14mm	24mm	35mm	50mm	85mm
f/1.4	f/2	f/2.8	f/4	f/5.6	3 – 32	4.9 – 52	5.9 – 62	6.6 – 66	8.2 – 66
f/2	f/2.8	f/4	f/5.6	f/8	2.3 – 23	3.6 – 36	4.3 – 46	4.9 – 52	5.9 – 66
f/2.8	f/4	f/5.6	f/8	f/11	2 – 16	2.6 – 27	3 – 32	3.3 – 36	3.9 – 44
f/4	f/5.6	f/8	f/11	f/16	2 – 11	2 – 19	2.3 – 23	2.6 – 26	2.9 – 33
f/5.6	f/8	f/11	f/16	f/22	2 – 7.9	2 – 13	2 – 16	2 – 18	2.3 – 23
f/8	f/11	f/16	f/22	f/32	2 – 5.6	2 – 9.2	2 – 11	2 – 13	2 – 16
f/11	f/16	f/22	f/32	f/45	2 – 3.9	2 – 6.6	2 – 7.9	2 – 9.2	2 – 11
f/16	f/22	f/32	f/45	f/64	2 – 2.6	2 – 4.6	2 – 5.6	2 – 6.6	2 – 8.2

Note: The SB-600 manual is incorrect in some of its range specifications. The above table is correct (though rounded slightly in some places). Red numbers can't be set in Program and Scene exposure modes; blue numbers can't be set on many Nikkor lenses.

To Set Manual Flash

1. Activate the flash. If it's already in Standby, a partial press of the shutter release activates it; otherwise, press the power (ON/OFF) button on the SB-600 to turn the flash ON.
2. Press the SB-600's **Mode** button until M appears on the LCD.
3. Set the D80 to Aperture-priority (A) or Manual (M) exposure mode and set your aperture and shutter speed, as usual.
4. Set the camera to Single Servo AF. While not absolutely required, this generally makes the camera's response more predictable.
5. Focus on your subject by pressing lightly on the shutter release. Note the distance on the scale on the lens.
6. Simply changing the aperture on the camera causes the SB-600 to match it. Unfortunately, the SB-600 doesn't have a distance scale, so you'll have to use `aperture=GN/distance` to determine the correct flash exposure, and use the Guide Number tables below to determine the GN.

Note: With lenses that don't have CPUs (AI and AI-S), the aperture on the camera isn't linked with the flash, so you have to adjust flash power settings on the SB-600 to control the flash output.

Note: The power setting of the SB-600 is controlled in 1/6 stop increments between ½ and 1/64 power (plus you can set full power, 1/1). You control the setting by pressing the ◀ and ▶ buttons on the flash direction pad to choose a value. Wait a moment and the flash locks in the current value.

Note: The SB-600 is capable of keeping up with the D80 at 3 fps at powers of 1/8, 1/16, 1/32, or 1/64 as follows:

1/8 4 consecutive frames
1/16 8 consecutive frames
1/32 16 consecutive frames

1/64 30 consecutive frames

However, let the flash cool at least 10 minutes after firing 40 consecutive flashes (normally this is 15 flashes in higher power and TTL modes).

SB-600 Guide Numbers at ISO 100 (feet)

Power	14mm	24mm	28mm	35mm	50mm	70mm	85mm
Full (1/1)	46	85	92	98	118	125	131
1/2	33	60	65	70	84	88	93
1/4	23	43	46	49	59	62	67
1/8	16	30	33	35	42	44	46
1/16	11.5	21	23	25	30	31	33
1/32	8.2	15.1	16	17	21	22	23
1/64	5.9	10.8	11.5	12.5	14.8	15.7	16.4

SB-600 Guide Numbers at ISO 100 (meters)

Power	14mm	24mm	28mm	35mm	50mm	70mm	85mm
Full (1/1)	14	26	28	30	36	38	40
1/2	9.9	18	20	21	26	27	28
1/4	7	13	14	15	18	19	20
1/8	4.9	9.2	9.9	10.6	12.7	13.4	14.1
1/16	3.5	6.5	7	7.5	9	9.5	10
1/32	2.5	4.6	4.9	5.3	6.4	6.7	7.1
1/64	1.8	3.3	3.5	3.8	4.5	4.8	5

Note: All numbers above 16 may be rounded to the nearest integer. That shouldn't impact calculations by enough to be visible.

To Manually Set the Zoom Head

1. Press the **Zoom** button on the flash direction pad to change the zoom setting. Each button press selects the next higher logical setting (and you'll eventually loop back to the lowest setting). The ZOOM M symbol appears on the LCD when the setting doesn't correspond to focal length of the lens.

Note: To cancel automatic zoom head setting and lock a manual setting, hold the **Zoom** *and* **-** *buttons for two seconds to enter the custom setting mode for the flash. Next, press the* **+** *button until you see the* ZOOM M*, and then press the* **Mode** *button to turn manual zoom* **On**. *Hold the* **Zoom** *and* **-** *buttons for two seconds to complete the setting.*

2. To cancel a manual zoom setting, press the **Zoom** button on the flash Direction pad until the **m** no longer appears on the LCD (e.g., until the setting matches the lens being used).

Note: Remember that the Guide Number of the flash changes with the zoom setting.

Note: If you pull out the built-in wide angle adapter and move it into position in front of the flashtube, the SB-600 is set to the 14mm and the automatic zoom head function cannot be set to another setting.

To Set Flash Exposure Compensation

Use the + and − buttons on the flash Direction pad to adjust the amount of compensation. The SB-600 allows a maximum of +3 stop and -3 stops of flash compensation, which is indicated in one-third stop increments on the flash compensation indicator.

Note: The flash may not be able to produce +3 compensation in some situations (e.g., if it's already firing at full power).

To cancel compensation, repeat the process outlined above and set a value of 0.0.

Note: Flash compensation does not change the background exposure calculated by the camera.

Tip: It's probably best to avoid flash compensation in any of the Balanced Fill-Flash TTL modes. You don't know what level of compensation the camera is already making, so any changes you make are in addition to this unknown, camera-calculated compensation. If you need absolute control, switch to Manual flash mode, where any compensation you dial in will be from a known flash level.

To Set Red-Eye Reduction

Set Red-eye reduction on the D80 by holding the Flash Options button on the camera and turning the Rear Command dial until 👁 appears on the D80's LCD).

Note: Red-eye reduction works in most flash modes, but not in the Repeating Flash mode.

SB-600 Notes

- The D80's focus mode should usually be set to Single Servo AF, since the flash will generally not fire unless the camera has achieved focus.
- The Autofocus Assist light on the SB-600 is used automatically if the ambient light is low and you haven't turned this function off on the flash. Autofocus assist only works at distances from 3.3 feet (1m) up to 33 feet (10m), and is only guaranteed to work with lenses from 24mm to 105mm.

Note: The Autofocus Assist illuminator will not function unless the central autofocus sensor is selected or Auto-area AF is in effect.

Note: You can turn off the Autofocus Assist illuminator on the SB-600 by holding the **Zoom** *and* **-** *buttons down for two seconds and using the SB-600's Direction pad to navigate to the option and turn it OFF.* **No AF-ILL** *will appear in the flash's LCD.*

- The SB-600 has an automatic standby power system. The SB-600 automatically turns off 40 seconds after the camera's meter turns OFF (**STBY** is displayed on the flash's LCD). A light press on the shutter release turns the D80's light meter back ON, and the SB-600 turns ON at the same time.

Note: The SB-600 has a "special" No Standby mode that can be set. Like the other flash command mode settings, you get to this function by holding the **Zoom** *and* **-** *buttons down for two seconds and then navigating the options with the Direction pad on the flash.*

- After the flash fires, an icon may appear in the flash's LCD along with a value. This indicates potential underexposure. This indicator only appears for three seconds after the shot.

- The Rear Sync option must be selected on the camera. (Some earlier flash units had this selection on the flash, so I've included this note here just in case folks who previously had one of those Speedlights are wondering.)
- While the SB-600 has "click stops" for commonly used flash head positions (45, 60, 75, and 90 degrees for tilt, every 30 degrees for rotation), you aren't restricted to those positions. Setting an intermediary position is allowed (though it can easily be dislodged).
- Viewfinder Ready Light Warnings (blinking) occurs in the following conditions:

  - When you press the shutter release halfway and the SB-600 is not correctly mounted on the hot shoe.

  - After the flash fires at full power, indicating possible underexposure.

SB-800

The SB-800 is the top of Nikon's flash lineup. The SB-800 is basically the same flash as the SB-80DX, but with additional features and support for the new i-TTL flash system. The SB-800 was announced in July 2003 and arrived in stores in fall 2003.

Specifications

GN:	125 (ft), 38 (m) (at 35mm head position)
Weight:	11.8 oz. (335g) (w/o batteries)
Size:	5" (127.5mm) tall x 2.8" (80.5mm) wide x 3.6" (91.5mm) deep
Power:	four AA batteries
Recycle Time:	6 seconds minimum (full discharge)
# of Flashes:	~150 at full manual
Flash Duration:	1/1050 to 1/41600
Coverage:	(120 degrees horizontal, 110 degrees vertical) 14mm lens; also supports 17mm, 24mm, 28mm, 35mm, 50mm, 70mm, 85mm, and 105mm coverage
Case:	SS-800 included
Key Features:	TTL flash control on the D80; Full power TTL, eight power level manual, and Automatic settings. LCD panel shows settings. Rear curtain sync. High Speed sync, Repeating flash, and red-eye reduction. The SB-800 can synchronize with up to nine additional flash units, in groups of three controlled by one master flash. Head tilts from –7 degrees below horizontal up to 90 degrees above horizontal, and rotates -270 degrees to plus 180 degrees clockwise. Built-in diffuser card. Diffusion dome included, sample filter set included. Automatic or Manual wireless remote firing possible. Modeling light. Wide angle autofocus assist light.

To Set TTL Flash

1. Activate the flash. If it's already in Standby, a partial press of the shutter release activates it; otherwise, press the power (ON/OFF) button on the SB-800 to turn the flash ON.

2. Select the type of TTL to be performed. Basically, you only have one choice: whether to cancel the "balanced fill-flash" mode (you do so by pressing the **Mode** button on the flash until only the **TTL** indicator appears; if **TTL BL** appears, the camera is in a Balanced Fill-Flash mode; see "Summary of i-TTL Flash Modes" on page <454>).

Note: The **FP** *indicator may also appear. This indicates that the flash is ready to perform high speed sync at shutter speeds faster than 1/200 if necessary.*

Note: When the D80 is set for spot metering, Standard TTL is set automatically.

3. Set the camera to Single Servo AF (flash operates best when the camera achieves focus; this isn't technically necessary, but I like to tell people to use it as a reminder that focus has to be achieved for flash to operate).
4. Set the camera's exposure mode, if you haven't already. In Aperture-priority (A), Shutter-priority (S), and Manual (M) exposure modes, make any necessary aperture or shutter speed selections.

Note: In Program exposure mode you can usually override the camera's selection of aperture and shutter speed combinations by turning the D80's Rear Command dial (when the camera is active). But note that the maximum aperture you can use is restricted in Program exposure mode (the actual value depends upon ISO setting; see "Allowable Apertures in Program Mode" on page <449>.

Note: The aperture the D80 (or you) selected also appears on the SB-800's LCD panel when you partially press the shutter release, as does the allowable flash-to-subject distance range.

Note: The D80 and SB-800 may warn you of several possible errors when you partially press the shutter release to verify settings:
- The lens must be set on its minimum aperture, or else the error message **FEE** *appears in the viewfinder.*
- Any **hi** *visible in the viewfinder indicates that overexposure (of the background exposure) is likely.*
- The shutter speed will be automatically reset to 1/200 if you selected a faster shutter speed in Shutter (S) or Manual (M) exposure mode.
- In Manual (M) exposure mode, under and overexposure is indicated solely by the analog exposure display. If the

exposure bar goes to either side of the ⁞ point, the ambient-only lighting exposure will not be correct.

5. Focus on your subject by pressing lightly on the shutter release. Confirm that the subject is within flash distance by looking at the Shooting Range displayed on the SB-800's LCD. Assuming you've confirmed the distance, you're ready to shoot.

SB-800 Usable Apertures and Flash Range in TTL mode (Feet)

ISO100	200	400	800	1600	14mm	24mm	35mm	50mm	85mm
f/1.4	f/2	f/2.8	f/4	f/5.6	3.5 – 27	6.6 – 66	7.8 – 66	8.8 – 66	10 – 66
f/2	f/2.8	f/4	f/5.6	f/8	2.5 – 27	4.6 – 52	5.5 – 62	6.2 – 66	7.2 – 66
f/2.8	f/4	f/5.6	f/8	f/11	2 – 20	3.3 – 37	3.9 – 44	4.4 – 50	5.1 – 56
f/4	f/5.6	f/8	f/11	f/16	2 – 14	2.3 – 26	2.8 – 31	3.1 – 35	3.6 – 39
f/5.6	f/8	f/11	f/16	f/22	2 – 10	2 – 19	2 – 22	2.2 – 26	2.6 – 29
f/8	f/11	f/16	f/22	f/32	2 – 7	2 – 13	2 – 16	2 – 18	2 – 20
f/11	f/16	f/22	f/32	f/45	2 – 4.9	2 – 9.3	2 – 11	2 – 12	2 – 14
f/16	f/22	f/32	f/45	f/64	2 – 3.5	2 – 6.6	2 – 7.8	2 – 8.8	2 – 10

Note: Red numbers can't be set in Program and Scene exposure modes; blue numbers can't be set on many Nikkor lenses.

To Set Manual Flash

1. Activate the flash. If it's already in Standby, a partial press of the shutter release activates it; otherwise, press the power (ON/OFF) button on the SB-800 to turn the flash ON.
2. Press the SB-800's **Mode** button until M appears on the LCD.
3. Set the D80 to Aperture-preferred (A) or Manual (M) exposure mode and set your aperture and your exposure, as usual.
4. Set the camera to Single Servo AF (flash operates best when the camera achieves focus; this isn't technically necessary, but I like to tell people to use it as a reminder that focus has to be achieved for flash to operate).

5. Focus on your subject by pressing lightly on the shutter release. Note the distance on the scale on the lens.

6. Simply changing the aperture on the camera causes the SB-800 to match it. You should see the aperture change on the flash unit's LCD and the Shooting Range distance changes, as well. You have two choices (you can also use a combination of both):

    a. Change apertures (on the camera) until the distance noted in Step 5 is also shown in the flash unit's LCD.

    b. Press the ▼ and ▲ buttons on the SB-800 to change the flash's power level until the distance noted in Step 5 is shown in the flash unit's LCD.

Note: With lenses that don't have CPUs (AI and AI-S), the aperture on the camera isn't linked with the flash, so you should adjust both aperture and flash power settings on the SB-800 until the Shooting Range on the flash unit's LCD indicates the distance you noted in Step 5, Then set the aperture on the camera to match that shown on the SB-800.

Note: The power setting of the SB-800 is controlled in 1/6 stop increments between ½ and 1/128 power (plus you can set full power, 1/1). You control the setting by pressing the ◀ and ▶ buttons on the flash direction pad to choose a value. Wait a moment and the flash locks in the current value.

Note: The SB-800 is capable of keeping up with the D200 at 5 fps at powers of 1/8, 1/16, 1/32, 1/64, or 1/128 as follows:

1/8 4 consecutive frames
1/16 8 consecutive frames
1/32 16 consecutive frames
1/64 30 consecutive fames
1/128 40 consecutive frames

However, let the flash cool at least 10 minutes after firing 40 consecutive flashes (normally this is 15 flashes in higher power, TTL, and A modes).

To Set Repeating Flash

1. Activate the flash. If it's already in Standby, a partial press of the shutter release activates it; otherwise, press the power (ON/OFF) button on the SB-800 to turn the flash ON.
2. Press the flash's **Mode** button until **RPT** appears on the LCD.
3. Put the camera in Manual (M) exposure mode.
4. Press the middle button on the flash direction pad (SEL)
    a. Then press the **+** and **-** buttons to choose the flash power setting (only settings between 1/8 and 1/128 are allowed).
    b. Press the middle button (SEL) again to lock in that value and the next portion of the entry is highlighted.
5. The number (frequency of flashes) next to the **Hz** should be highlighted. If not, Press the SEL button until the number next to the label **Hz** is highlighted.
    a. Then press the **+** and **-** buttons on the flash direction pad until the frequency you want is shown on the LCD.
    b. Press the middle button (SEL) again to lock in that value and the next portion of the entry is highlighted.
6. The number (number of flashes) at the far left of the LCD should be highlighted. If not, Press the SEL button until it is.
    a. Then press the **+** and **-** buttons on the flash direction pad until the number you want is shown on the LCD.
    b. Press the middle button (SEL) again to lock in that value.

Maximum Number of Repeating Flashes at Each Power Setting

	1/8	1/16	1/32	1/64	1/128
1-2 hz	14	30	60	90	90
3 hz	12	30	60	90	90
4 hz	10	20	50	80	80
5 hz	8	20	40	70	70
6 hz	6	20	32	56	56
7 hz	6	20	28	44	44
8 hz	5	10	24	36	36
9 hz	5	10	22	32	32
10 hz	4	8	20	28	28
20-100hz	4	8	12	24	24

7. Set your shutter speed. It must be equal to or slower than **Number of Flashes / Frequency of Flashes**. For example, with 4 flashes at 8 Hertz, you'd need a shutter speed of ½ second or longer.

8. Note the distance displayed on the SB-800's LCD. (Note: changing the zoom head setting also changes the shooting distance.) This is the flash-to-subject distance you must use (e.g. if your subject is further away than this distance, you're going to have to move closer or change your settings).

Note: Nikon's flash documentation for repeating flash says the exposure "is the correct exposure for the first flash in the sequence." Actually, it's the correct exposure for each flash in the sequence, but if your subject doesn't move between exposures, the overlap may result in overexposure. If you're in doubt, bracket (though in this case, you'd bracket the number of exposures or frequency).

Also: place your subject against a dark background or underexpose the background. Failure to do so may result in one of two problems: (1) the background receives light from the multiple flashes and becomes overexposed; or (2) the subject appears to fade into the background (especially

true if you're off by a bit in your distance). If in doubt, bracket your exposures for the background!

To Manually Set the Zoom Head

1. Press the ◀ and ▶ buttons on the flash direction pad to change the zoom setting. Each button press selects the next higher logical setting (and you'll eventually loop back to the lowest setting). The M ZOOM symbol appears on the LCD when the setting doesn't correspond to focal length of the lens.

Note: To cancel automatic zoom head setting and lock a manual setting, hold the SEL button for two seconds to enter the command setting mode for the flash. Next, press the − until you see the m above ZOOM and the words **SEL** *and* **OFF** *on the LCD. Then use the ◀ and ▶ buttons to change the value (ON means the manual focus setting is locked, OFF means it isn't). Hold the SEL button for two seconds to complete the setting. To cancel the lock, repeat the process and select the other value.*

2. To cancel a manual zoom setting, press the ◀ and ▶ buttons on the flash direction pad until the **m** no longer appears on the LCD (e.g. until the setting matches the lens being used).

Note: Remember that the Guide Number of the flash changes with the zoom setting.

Note: If you pull out the built-in wide angle adapter and move it into position in front of the flashtube, the SB-800 is set to the 14mm or 17mm focal length and the automatic zoom head function cannot be set to another setting. Likewise, if you put the diffusion dome on the flash head, the SB-800 sets 14mm as the focal length, and this can't be changed.

To Set the Distance Scale to Feet or Meters

1. Hold the SEL button for two seconds to enter the command setting mode for the flash.
2. Press the ▶ until you see the **m/ft** box highlighted on the LCD.

3. Press the SEL button again.
4. Use the ▲ and ▼ buttons on the flash direction pad to highlight the value you desire (**m** for meters, **ft** for feet).
5. Hold the SEL button for two seconds to complete the setting.

To cancel the lock, repeat the process and select the other value.

To Set Flash Exposure Compensation

Use the + and − buttons to adjust the amount of compensation. The SB-800 allows a maximum of +3 stop and -3 stops of flash compensation, which is indicated in one-third stop increments on the flash compensation indicator.

Note: You may not be able to achieve +3 flash exposure compensation in some situations.

To cancel compensation, repeat the process outlined above and set a value of 0.0.

Note: Flash compensation does not change the background exposure calculated by the camera.

Note: You can also set flash exposure compensation on camera bodies that have an internal flash, such as the D80 body. If you do this, the value is cumulative with that you set on the external flash. Get in the habit of only setting the flash exposure compensation in one place, if possible (hint: if you own a D1, D2h, or D2x, flash exposure compensation should be set on the flash, since that's the only place you can set it!).

Tip: It's probably best to avoid flash compensation in any of the Balanced Fill-Flash TTL modes. You don't know what level of compensation the camera is already making, so any changes you make are in addition to this unknown, camera-calculated compensation. If you need absolute control, switch to the Auto Aperture or Manual flash modes, where

any compensation you dial in will be from a known flash level.

To Set Red-Eye Reduction

Set Red-eye reduction on the D80 by holding the Flash Options button on the camera and turning the Rear Command dial until ⊙ appears on the D80's top LCD).

Note: Red-eye reduction works in most flash modes, but not in the Repeating Flash mode.

SB-800 Notes

- The SB-800 uses the same European style power connector as the SB-28DX, thus the SD-8A is the high performance battery pack to use, not the SD-8.
- The D80's focus mode should usually be set to Single Servo AF, since the flash will not fire unless the subject is in focus.
- The Autofocus Assist light on the SB-800 is used automatically if the ambient light is low and you haven't turned this function off on the flash. Autofocus assist only works at distances from 3.3 feet (1m) up to 33 feet (10m), and is only guaranteed to work with lenses from 24mm to 105mm.

Note: The Autofocus Assist illuminator will not function unless the central autofocus sensor is selected or Auto-area AF is in effect.

Note: You can turn off the Autofocus Assist illuminator on the SB-800 by holding the **Sel** *button down for two seconds and using the SB-800's Direction pad to navigate to the option and turn it OFF.* **No AF-ILL** *will appear in the flash's LCD.*

- If the **F** indicator on the SB-800's LCD panel is blinking, that means that the flash needs you to set the aperture. This happens in several situations: (1) in Automatic (A) flash mode; or (2) when using lenses without a CPU (AI or AI-S lenses). If the **F** is blinking, use the + and − buttons to set the correct aperture on the flash (e.g. the aperture that matches what is set on the camera).

- The SB-800 has an automatic standby power system. The SB-800 automatically turns off 40 seconds after the camera's meter turns OFF (**STBY** is displayed on the flash's LCD). A light press on the shutter release turns the D80's light meter back ON, and the SB-800 turns ON at the same time.

Note: The SB-800 has a "special" No Standby mode that can be set, as well as the ability to set different time-out values (80, 160, 300 seconds). Like the other flash command mode settings, you get to this function by holding the **Sel** *button down for two seconds and then navigating the options with the Direction pad on the flash.*

- After the flash fires, an icon may appear in the flash's LCD along with a value. This indicates potential underexposure. This indicator only appears for three seconds after the shot.
- The Rear Sync option must be selected on the camera. (Some earlier flash units had this selection on the flash, so I've included this note here just in case folks who previously had one of those Speedlights are wondering.)
- While the SB-800 has "click stops" for commonly used flash head positions (45, 60, 75, and 90 degrees for tilt, every 30 degrees for rotation), you aren't restricted to those positions. Setting an intermediary position is allowed (though it can easily be dislodged).
- Viewfinder Ready Light Warnings (blinking) occurs in the following conditions:

  - When you press the shutter release halfway and the SB-800 is not correctly mounted on the hot shoe.

  - After the flash fires at full power, indicating possible underexposure.

Flash Troubleshooting

Problem: Your SU-4 doesn't seem to trigger the remote flash correctly in TTL mode.
Solution: The D80 is not really compatible with the SU-4 in TTL modes. Nikon states that you must set the triggering flash unit to Automatic (A) flash mode. That's not 100% correct.

You can use **FV Lock** to get around the preflash prematurely triggering a remote SU-4 (see "Wireless Flash" on page <476> for an example of this). A better solution is to purchase additional SB-800's and use them in wireless TTL mode.

Problem: You can't get an SB-27 Speedlight to work on a D80.
Solution: Non-DX flash units need to be set to Automatic or Manual flash mode, and the SB-27 has some unusual wrinkles concerning Automatic flash mode. If you want to use manual flash mode, just slide the flash mode selector switch on the SB-27 to M and perform manual flash as usual. To use Automatic flash mode with the SB-27, you need to open the battery compartment of the flash unit and make sure that the switch inside is *not* set to TTL (the default). Then, starting with the flash power OFF, hold down the **ZOOM** button on the SB-27 while turning its power switch to **AUTO**. You may have to perform this last action more than once, as each time you perform it the flash cycles through to only the next available flash mode. You want the "Forced Auto" mode, and the indicator for that is that the A on the SB-27's LCD blinks.

Problem: The Flexible Program function in Program exposure mode doesn't seem to change the shutter speed or aperture at all; the top LCD shows **P*** but the shutter speed and aperture don't change.
Solution: *Get out of Program mode*! If you read the Nikon manuals closely enough, interpret between the lines, consult a good tarot card reader, and sacrifice enough chickens you learn that:

- In Program exposure mode, the maximum aperture that can be used is highly restricted. On a D80 at the lowest ISO, the largest aperture you can set with an external flash is f/4.
- In Program exposure mode, the minimum shutter speed is locked at 1/60.
- In Program mode in dim conditions (and f/4 at 1/60 isn't all that dim, is it?), you not only are locked into basically

one aperture/shutter speed combo, but the ambient light in the scene *will be severely underexposed*.

At a minimum, you should use the Slow Sync option or Custom Setting #24 (see page <433>) to lose the slow shutter speed restriction. But I'd recommend that you switch to Aperture-preferred exposure mode to also remove the aperture limitation.

Using a D80 in the Field

Using a D80 is very much like using a Nikon film SLR with slide film. Very few practical differences enter into the picture. This section deals with those differences and other more generic issues that come up while shooting with the D80.

The "Routine"

Here's a simple, structured set of things to consider at different points in your shooting routine:

General Settings You Make Once

- Adjust the viewfinder's diopter setting.
- Set the date, time, and language.
- Set Custom Settings that control camera defaults for how you normally want the camera configured (Beep, Instant review, etc.).

I usually double-check the diopter and Custom Settings every time I change the battery. It's easy to dislodge the diopter setting, and if I've handed the camera to anyone else (common during workshops) I've found it wise to double-check my custom settings at that time, too.

Things to Do Before You Head Out on a Shoot

- *Clean the mirror box and sensor*. I know I'll get grief over this one, as it's a lot of hassle, and if you haven't changed lenses lately it shouldn't matter, right? Wrong. The sensor has a propensity to attract small particles, regardless of whether you had the lens off or not. Even if the sensor was cleaned last time you used the camera, there's a chance that another particle has already migrated to the interior of the camera, especially since the mirror flip and curtain open move a bit of air around. Unlike film cameras, where you tend to clean *after* a shoot, I've found it more useful to do all my cleaning with digital bodies *before* a shoot.

- *Likewise, clean your camera bag and accessories*. Dust comes from two sources: the environment you shoot in, which requires defensive techniques to control; and unclean working practices, such as allowing a camera bag to accumulate dirt and dust, not cleaning lenses after use, etc. At least start the shooting session with everything clean; it'll postpone the inevitable dust specks.
- *Format the Secure Digital cards you'll be using*. First, though, check to see if it has any files on it (see "Things to do After Each Shooting Session" on page <511>). Formatting deals with any bad sector and fragmentation problems, and if you're using the D80 and other cameras with the same card, can help keep folder proliferation and the renumbering it causes to a minimum.
- *Top off your batteries*. I carry a converter/charger in my auto just in case I forgot to top off my battery—as a last resort I run a charge while driving to the shoot. Fortunately, the D80's battery handles "top-offs" just fine (some other batteries prefer to be completely discharged prior to charging). Don't forget the batteries for your flash and accessories, if any.
- *Verify that you have everything you need for the shoot*. Personally, I like checklists, which keep me from forgetting various cords I might need or my backup storage devices. With a D80, that list needs to include things like the BF-1A camera body cap, and emergency cleaning equipment. If I'm teaching a workshop, I have to remember my video cable and extension.

  Simplified Checklist (a more elaborate, printable checklist is on the disc—look for **D80 Checklist**):

  __ Camera body (bodies)
  __ Extra batteries
  __ Charger (if needed, with cables)
  __ Lenses

__ Lens accessories (filters, hoods, teleconverters, extension tubes)

__ Support (tripod, head, monopod, plates, etc.)

__ Flash

__ Batteries for flash (or cable to external battery)

__ Flash bracket, sync cable (SC-17), etc.

__ Cleaning equipment (AC power, swabs, fluid, air, etc.)

__ Caps (body cap, lens caps, etc.)

__ Storage (Secure Digital cards, Coolwalker, etc.)

__ Cards (gray card, white balance card, etc.)

__ Cables (FireWire, video, AC power, etc.)

__ Laptop with PictureProject/Capture NX and plenty of storage space

__ Other (card reader/PCMCIA adapter, rain cover, etc.)

Check Each Time You Turn the Camera ON

- *Check the battery level*. Put in fresh battery, if necessary. This is important because if the camera sits unused for a long period of time, the battery will still deplete, as it powers the overlay to the viewfinder even when the camera is turned OFF.
- *Check the frames remaining indicator*. Format or replace the Secure Digital card, if necessary. If it seems like the frames remaining number is lower than it should be, ***check your Image Quality setting!*** Also check to make sure that there aren't images remaining on the card that you haven't yet saved to the computer.
- *Check that you haven't overridden any settings*. Check especially for exposure compensation, bracketing, ISO value, frame advance, and image quality and size settings.
- *Take one more careful look at the top LCD*. This is a redundancy check for all three previous checks. Partially press the shutter release when you do (sometimes this triggers blinking of an icon, which may remind you that you set something you need to restore). Moreover, it'll remind you which exposure and flash mode you've set.

Settings You Change Rarely (and then only for a reason)

- *Set a frame advance mode*. Single frame or one of the Continuous advance options are the primary choices. But you might also set the self timer or remote control options for certain circumstances.
- *Set focus options*. Single Servo (AF-S) or Continuous Servo (AF-C), plus Single Area, Dynamic Area, and Auto-area AF are your primary choices. Wide area versus Normal area is another autofocus option. The camera's defaults are a good starting point, but will slow autofocus operations in almost any continuous movement situation.
- *Set a metering method*. Matrix, center-weight, or spot meter are the choices. Matrix is your usual choice. Get in the habit of looking at the indicator often; it's conveniently right next to the viewfinder, so a quick glance at it before you put your eye to the camera is simple to do.
- *Set ISO sensitivity*. Use the lowest ISO that gives you acceptable shutter speeds.
- *Set an exposure mode*. Avoid Program and the Scene exposure modes if you can, especially with flash. Aperture priority is my usual choice.
- *Set a flash mode*. This one's a little tricky. The external flash mode (TTL, Automatic, Manual, etc.) is controlled with the **Mode** button on the flash. The internal flash mode is controlled by Custom Setting #22 (see page <429>). If you've set TTL, the *type* of TTL performed (Balanced Fill-Flash, Standard TTL) is affected by other camera settings (spot metering) for the internal flash, but can be manually set for external flash units. Because of that difference, you need to pay careful attention to flash settings when going back and forth between internal and external flash use.
- *Most Custom Settings*. Very few of the custom settings are things that you'd change often.

- *Set* **Image quality** *and, if you're shooting JPEG, an* **Image size**. Most photographers shoot either **NEF**, **JPEG FINE Large**, or a specific size determined by their needs.
- *Multiple exposures*. This item tends to be used for special purposes.

I try to make it a practice to check these settings every time I replace a battery or Secure Digital card, just as I used to do when switching rolls of film on a 35mm film body. **Always watch the ISO setting!** You never want to shoot with a high ISO set unless you absolutely have to, as noise is higher, producing less desirable image quality results.

Settings You Change Often

- *Set a white balance value*. **Auto** works only in a limited range of lighting, so learn to recognize when you're outside that range and set either a specific value or use a gray card with **PRE**.
- *Select a focus area*. For Single Area AF you're selecting the actual sensor used, for Dynamic Area AF you're selecting the starting focus sensor. In Auto-area AF your selection is ignored.
- *Set exposure compensation*. Especially true if you use matrix metering and are moving in and out of high contrast scenes, which the meter doesn't handle as well. Use the histogram to determine if you need to change the exposure.
- *Set exposure bracketing*. Pay close attention, though, as the D80 can be set to bracket white balance as well as exposure; the controls are the same and Custom Setting #13 selects which is in effect (see page <415>).
- *Set apertures and/or shutter speeds (or override the Program exposure mode)*.

It pays to get in the habit of making a quick visual check for these settings as often as possible (e.g. just before every shot, if possible). Fortunately, the D80 has almost all of your critical settings visible in the viewfinder (the only critical missing one is white balance).

Tip: The big "gotchas" are white balance and exposure compensation. When you're working in a hurry, it's easy to forget that you overrode the camera for these. Fortunately, the viewfinder reminds you of your settings for the latter, and the top LCD displays the former. Get in the habit at looking at both those settings when shooting.

Things to Do After Each Shooting Session

- *Move the image files to your computer ASAP.* Working in the digital realm requires discipline. Remember, the D80 is labeling files with numbers, and the Nikon DSLRs have the entertaining trait of restarting the numbering in a variety of ways that'll catch you off guard. If you don't make it a habit to move files to meaningful folders (and meaningfully rename the files, see "Digital Workflow" on page <600>), you'll end up with hundreds of files with similar and possibly duplicate names that you have to slog through to find the one you want. Besides, if you make it a practice to immediately download the image files, you won't ever accidentally format a card with information you wanted to keep.
- *Verify that the files transferred correctly!* Open one or two of the files to make sure that they transferred without error. Many serious photographers also burn a CD-ROM backup of their original files at this stage and securely store this as their "original negative." Personally, I use portable hard drives for backup, as it makes the process faster and I only have to keep track of one extra thing.
- *Format the Secure Digital cards immediately after you download the files from them.* Yes, I told you to format them just before each shooting session, so this seems redundant. But if you follow both instructions, any card you notice with files on it probably hasn't been downloaded to the computer yet, giving you one last chance to recover those original files before you erase them.
- *If you're going to shoot again within the next week, put your partially exhausted batteries on the charger.* Since you can't count on running into a drugstore and buy

batteries that'll run the D80, you also need to stay disciplined in keeping your batteries topped off, lest you find yourself in a situation where you run out of power at the most inopportune time (yes, it's happened to me; don't let it happen to you). If you're not going to be shooting with your D80 in the next month or so, make sure the battery has a mid-level charge (not full or empty) in it before storing it outside the camera.

- *Cancel any special settings you made*. In particular, set the camera back to:
  - No exposure compensation.
  - Bracketing OFF.
  - The lowest ISO value.
  - Your preferred exposure and flash mode.
  - Automatic white balance.
  - Return any one-time custom settings to their usual value (or, if you're like me and only use another settings bank for special situations, return the camera to your normal custom settings bank).

- *Clean the camera (but not the sensor)*. Don't put the camera away dirty, as this just tends to leave dirt and dust around that will eventually make its way into the mirror box. Since I use my D80 in the backcountry, I make a habit of opening all the doors and blowing dirt and dust out of every nook and cranny. I don't clean my sensor when I return from a shoot, as I've noticed that if my camera sits for a day or two, dust always seems to settle on the clean sensor. Thus I always leave my sensor cleaning for just before leaving for shoots.

Keeping Track of Batteries

If you use the D80 heavily you may find that one battery doesn't always get you through a full day of shooting (it might though). Thus, most D80 users carry multiple batteries with them.

The EN-EL3e battery doesn't have any external mechanism for showing whether it is fully charged or not. If you carry three

batteries, as I sometimes do, you need some way of telling the charged batteries from the used ones. Here are some of the methods I've heard:

- *Number the batteries.* Using some sort of permanent marker, number each of your batteries, and then use them in numbered order. If you pull battery #2 out of the camera, you know to use battery #3 next (and that batteries #1 and #2 need charging). (If you put a small label on the battery you can also put "tick" marks on the label each time you charge it, which helps you balance the use of your batteries.)
- *Use rubber bands.* When I take a battery off the charger, I slip a small rubber band [135] over its body. Since I can't put the battery into the camera without taking the rubber band off, any battery I find in my pack with the rubber band on must be charged and ready for use. To keep the rubber band from falling off, make sure to wrap it around the battery so that it falls in the "crease."
- *Use the battery cap.* One clever user has placed green and red stickers on the bottom of his EN-EL3 batteries and then cut out a section of the plastic battery cap that Nikon supplies so that the color shows through. By careful placement of the stickers and by reversing the cap, either the red or the green sticker shows through.

[135] Rubber bands are also useful for getting stuck filters off the lens.

Maintaining Image Quality

You'll get the highest quality images out of the D80 if you:

- *Shoot NEF format*. You have the original sensor data to deal with, and can apply different interpolation routines on it after the fact. The D80 JPEG engine seems just a teeny bit "soft" to me, though not nearly as bad as the D100 was. If you don't shoot NEF, see "Dealing with JPEG" on page <517>. Note that you don't have to shoot NEF+JPEG if all you're looking for is a for-position-only JPEG. All you need is a tool to extract the embedded JPEG preview from the NEF file.
- *Get the exposure right*. Incorrect exposure has impacts on all kinds of image quality issues, including visibility of noise, contrast, and much more. See "How to Interpret Histograms" on page <230>. Any underexposure of a D80 image tends to produce more visible noise, especially if you adjust the exposure later in post-processing. Note that you can check channels individually on the D80, so there's no excuse for blowing a channel, either. However, to keep from doing so when you're shooting NEF, you should also set the proper white balance setting (the histograms are calculated from the embedded JPEG, which means that the white balance data is reflected in the histogram!).
- *Keep the sensor clean*. Even with Photoshop's Healing Tool or Capture NX's Dust Off function, you'll still end up spending a lot of time cleaning up dust bunnies in large bright areas of images shot at small apertures. Plenty of quick and good cleaning options exist now, so use one regularly, such as the SensorBrush. See my Web site for more (http://www.bythom.com/cleaning.htm).
- *Shoot at the lowest ISO you can*, and use **Long exp. NR** (noise reduction; on the SHOOTING menu) on exposures over 8 seconds. (This form of noise reduction does not lower detail.) Once noise is recorded in an image, getting it out is difficult at best, impossible at worst. ISO 100 is where you want to be as often as possible—at this value the D80's images are remarkably noise free and have a

great deal of detail and clarity. If you shoot at high ISO values you have to make a choice: detail or not. Turning on **High ISO NR** (noise reduction) will cause loss of some detail in JPEG images, though the noise will be better controlled.

- *Watch your focus.* If you intend to print at sizes larger than 8x10" (~ISO A4), you should realize that depth of field on a D80 is a bit smaller than for the same focal length, focus distance, and aperture combination on a 35mm body (see "Depth of Field Preview" on page <349>). Most of us who shoot NEF set **Sharpening** to **Medium High** or **High** on our D80's. This allows us to use the D80's excellent thumbnail zoom capability to examine and better evaluate focus. If you leave your sharpening value set lower, the slight graininess of the color LCD coupled with the interpolation the camera is doing on the thumbnail will make it harder to see the actual focus point.
- *Learn to recognize what triggers moiré.* Any regular pattern of small detail can trigger the dreaded moiré. This colored pattern is even more difficult to remove from images than noise. Changing focal length and camera-to-subject distance are your only real tools in reducing moiré. Fortunately, it takes a very small, tight pattern to trigger moiré on the D80, and these don't occur as often as the patterns that trigger the problem on the D70.

Which Type of Photographer are You?

Most D80 users will fall into one of two camps of photographers:

- *"I want mostly automatic."* This type of photographer wants the quality a DSLR produces, but generally doesn't want to have to pay a lot of attention to details. They're likely to drop their photos off to a lab to be printed, and less likely to crack open a software program to "fix" or adjust their images after the fact.
- *"I'm willing to invest time to get it right."* This type of photographer wants the very best quality images they can

produce with their D80, and is willing to spend as much time and energy that it takes to get everything right.

The first of these—the automatic shooters—should probably have their camera set the following way most of the time (note that the settings shown with an *, are *not the camera defaults,* so you'll have to set them manually once):

Long Exp NR	On*
High ISO NR	Off*
Image Quality	Fine
Image Size	Large
JPEG Compression	Optimal Quality
White Balance	Auto
ISO	Auto ISO to 400, maybe 800*
Optimize Image	Sharpening +1*
	Tone Comp Normal*
	Color Mode I for portraits, III for scenics*
Autofocus Mode	AF-A (Auto Servo)
Autofocus Area Mode	Auto-area AF
Metering Method	Matrix Metering
Internal Flash Mode	TTL
File No. Seq.	ON*
Image Rotation	ON

As for exposure mode, I'd suggest Aperture-priority, though Program exposure mode is okay if you avoid using the flash.

With the camera set as described, you'll get very usable, slightly warm pictures out of the camera with minimal hassle. These photos will work on the Web, with PictBridge printers, and with most labs. You're compromising a bit on image quality (automatic White Balance can produce slightly off color images, but usually only slightly). Read the section on "Dealing with JPEG," below, for more tips on image quality.

The Autofocus system will work hard to figure out what is and isn't the subject, but it will get focus wrong some of the time (most often when the subject of choice is behind something else or when the subject of choice has little or no contrast).

If you're trying to get the most quality you can out of your D80, then you'll be changing your settings quite a bit to optimize for each situation you encounter. A few, however, need to be called out here:

Image Quality	NEF (Raw)*
ISO	100 to 400 max
White Balance	PRE* or actual condition*
Optimize Image	Sharpening None*
	Tone Comp Normal* (possibly Custom)
	Color Mode II for everything*
Autofocus Mode	AF-C* (Continuous Servo)
Autofocus Area Mode	Dynamic Area*

The remainder of the settings would either be the same as for the automatic shooter, or would vary with every situation you encounter. Again, I'd suggest Aperture-priority exposure mode (unless you're shooting sports, in which case I'd suggest Shutter-priority exposure mode).

The reason why for highest quality you go to NEF and Color Mode II (AdobeRGB Color Space) is to try to get every last bit of color capability out of the camera—to do that you need to shoot raw files and convert them after the fact in the largest Color Space possible [136]. Using a measured White Balance (**PRE**) is the best way to get the best color and exposure out of the D80, but if you know what you're doing, you can set Kelvin directly.

Dealing with JPEG

If you shoot JPEG with a D80, you need to master the camera's digital manipulation settings. In particular, white balance, contrast, and sharpening settings often determine how good the final picture is:

[136]Technically, AdobeRGB isn't the largest Color Space possible and raw files don't have a Color Space, per se, but from a simplified workflow standpoint, you'd normally set AdobeRGB on both your camera and your computer software.

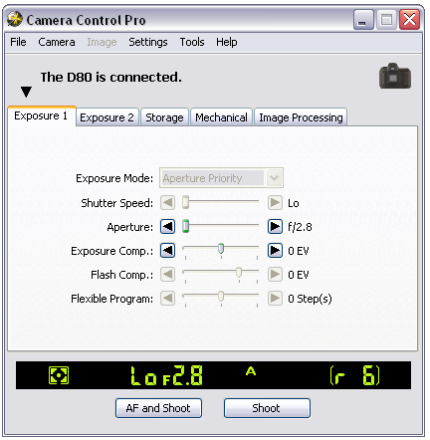
- *Consider using* **Less contrast** *or* **Normal**. While the defaults in the D80 have a tendency to use the **Less contrast** setting for **Tone Compensation** in higher contrast scenes, there is no guarantee that this is what is set when the camera encounters a wide disparity between the brightest and darkest portions of the image. If contrast is set to **Normal**, or worse still, **More contrast**, you may discover that the highlights are blown out and unrecoverable on your JPEGs (and the shadow areas may be dark and muddy in color). Some D80 users go further and suggest the **Low contrast** value as the proper one. If you shoot in higher contrast scenes then **Low contrast** is probably the correct call, though it'll mean that you have to post-process your images more often. The point is: don't let the camera make the call, and set something on the low side, not the high side.
- *Don't overexpose!* Coupled with the contrast changes introduced with the JPEG format is a related issue: any overexposed area in the resulting shot is very likely to have blown-out (detail-less) highlights. You're better off trying to "recover" information in the shadows on JPEGs than from the highlights; indeed, the camera has a built-in capability called **D-Lighting** to help you do so (see page <553>). (Someone once tried to explain the math to me, which, since it involved complex Fourier transforms, went a bit over my head. But the essence of the message was this: because of the way JPEG transforms individual pixel data into formulas, you're slightly more able to "recover" useful information in dark areas than bright.)
- *Use any Sharpening setting at ISO 100.* Amazingly, the D80 manages to not produce sharpening artifacts, even in JPEG images. Whatever rendering Nikon is using (remember, it's prior to reduction to 8-bit), the edges are generally clean and free from mosquito artifacts, at least at the base ISO. Indeed, most D80 images that are sharpened in camera can be sharpened again in post processing without much worry, something that wasn't true on most previous Nikon bodies. I tend to set my D80 to **+1** sharpening in camera, as it helps me evaluate focus

when zooming in on the preview image on the color LCD. Note, however, that as you go up the ISO ladder, you almost certainly will want to begin reducing your sharpening value.

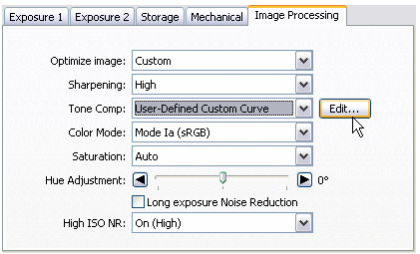
Custom Curves

You'll need Nikon Camera Control Pro and a USB cable between your computer and your D80 to set and use Custom Curves, but if you shoot primarily JPEG images, you may find this ability useful.

1. Connect your D80 to your computer via USB. (If the Windows download options dialog comes up, click **Cancel**).
2. Start Nikon Camera Control Pro on your computer.

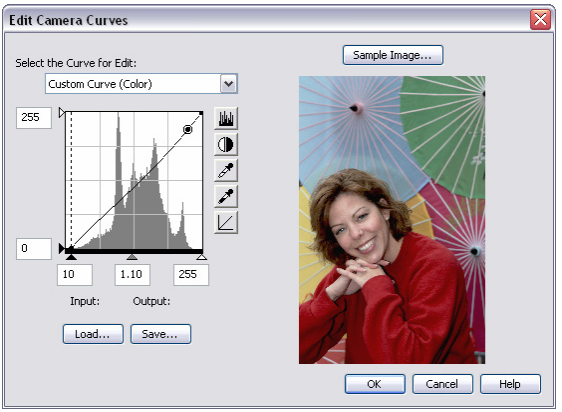


3. Move to the **Image Processing** tab. Select **Custom** for **Optimize image** and **User-Defined Custom Curve** for the **Tone Comp** setting, and then click on the **Edit** button.



4. Click on the **Sample Image** button and load a typical image you've shot so that you can see the effect your curve will have as you change it.

5. Edit the curve in the histogram/levels area at the left of the dialog. I tend to start with the following changes:



   a. Set the Black point (left boxed number below the histogram) to between 5 and 10. (If you like Velvia-type blacks, you may want to consider pushing this value even higher. Personally, on the D80 I tend to like a black level of about 10—it masks noise at the expense of a bit of dynamic range.)

   b. Click on the diagonal line at the seven-eighths point to create an adjustment point: raise or lower the adjustment point slightly.

   c. Click on the diagonal line at the one-eighth point to create an adjustment point: lower the adjustment point slightly.

   d. Consider changing the "gamma" value (the middle box below the histogram) to a value of between 0.95 and 1.1. Gammas higher than 1.0 will lower contrast and boost midrange values; lower than 1.0 will increase contrast.

6. Click the **Save** button and give this Curve a name and save location.
7. Click the **OK** button to load the curve to the camera.
8. On the camera, make sure you set **Custom** as the **Tone Comp** value.

What exactly did we do here? Essentially we've changed the "linearity" of how the camera converts photosite data to pixel data. We've made very dark things go darker but most shadow and midrange details go brighter, which is the adjustment most D80 users make to their images when they expose for the highlights, as I suggest elsewhere. Overall, an image recorded with this curve would tend to have a bit more contrast deep in the shadows, a bit less in the middle and highlight tones.

Color fidelity is altered slightly whenever you use post-process data using custom curves (yes, the change occurs post demosaicing). But if you keep your adjustments modest, any color shift can be kept minor and acceptable.

Note: You really only need to use custom curves with JPEG images, as you can perform the same sort of function after the fact with NEF images using Nikon Capture NX.

*Tip: I've supplied two basic curves on the CD that you can load into your camera to get some idea of how they work. The first (*ThomStandard*) is similar to the one I've just shown, the second (*ThomMore*) is a more exaggerated version. To load them:*

1. Connect the camera via USB.
2. Start Nikon Camera Control Pro.
3. Click the **Image Processing** *tab.*
4. Set **Image optimization** *to* **Custom**
5. Set **Tone Comp** *to* **User-Defined Custom Curve**.
6. Click the **Edit** *button.*
7. Click the **Load** *button and navigate to the CD's curves.*
8. Click the **OK** *button.*

Color Profiles, Color Spaces, and Color Modes

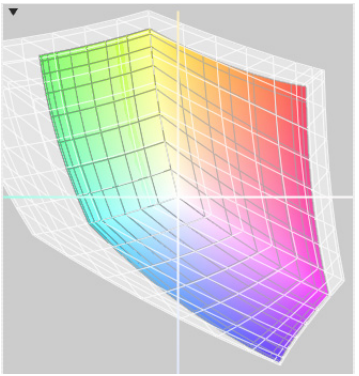
Color management is a topic worthy of its own book (indeed, it has one: Real World Color Management by Bruce Fraser, Chris Murphy, and Fred Bunting). But if you want to get the best possible results from your camera, you need to know a few things about profiles, Color Spaces, and Color Modes.

The D80 allows the user to choose between two Color Spaces: sRGB (**Color Mode I** and **III**) and AdobeRGB (**Color Mode II**).

Color Spaces (also sometimes called gamuts) define the range of colors that are available to be reproduced. Imagine a world where there are only five shades of a red versus a hundred shades of red. Identical scenes would look different in those two worlds, no? In a simplified way, that's what we face with color reproduction methods. Television screens (and monitors) can reproduce one range of colors, an inexpensive printer another range, and expensive multi-plate print technologies yet a different range. The inks in printing (or the phosphors and shadow mask in monitors) can limit (or increase) the color range.

In a perfect world, the color range of your capture device (e.g., your D80) would match that of your editing device (e.g., your monitor), which in turn would match that of your printer. In that perfect world, colors captured by the camera would be maintained perfectly, right through to the final printed image.

A Color Space defines how narrow or wide the color range is and what a particular RGB value should represent. The D80 doesn't allow you to "set" the Color Space directly; instead you have to choose it via a **Color Mode** setting.



Color Mode I and **III** (sRGB Color Spaces) are narrow gamut Color Spaces (the inner, colored area in the CIE chart, shown above) best suited for computer monitors and many commercial lab printers, while **Color Mode II** (AdobeRGB Color Space, the outer, gray-shaded area in the illustration) is a wider gamut Color Space that is generally better for printing on high-fidelity equipment. As you can see, both Color Spaces are nearly equal in the blue corner, but sRGB extends less into the red and quite a bit less into the possible green range.

Tip: *If you've got a Macintosh and want to compare gamuts, start the* **ColorSync Utility** *application, click the* **Profiles** *icon, choose a Color Space, click the little triangle in the upper left corner of the plot area and then select* **Hold for Comparison** *from the pop-up menu that appears. Then select another Color Space. You'll get a dual-plot similar to what I've shown above.*

Color Mode I and **III** (sRGB Color Spaces) tend to produce intense, saturated colors at the expense of subtle tonality. Microsoft and Hewlett-Packard originally co-developed the sRGB Color Space for computer monitors. Their choice was to use the lowest-common denominator approach: what was the largest Color Space that *every* monitor can reproduce? The result was a narrow range that tends to exaggerate saturation, which also adds a perceptual increase in contrast to most images.

If you shoot pictures to be used on Web sites or in computer-based products, **Color Mode I** and **III** are the Color Space setting to use, though their narrow nature doesn't give you much flexibility in subtle color adjustments. Also, if you expect to print directly from your storage card (either on a DPOF or PictBridge-aware printer or at a photofinisher that uses, say, a Fuji Frontier), then you should probably choose **Color Mode I** or **III** for your Color Space.

Color Mode II (AdobeRGB) is a wider Color Space, intended for print technologies that can reproduce a large range of subtle color differences. If you intend to take pictures for print on your own personal inkjet or high-end digital printer, I suggest that you select **Color Mode II** (AdobeRGB) as your Color Space. Note that colors may seem to be less saturated when displayed on your computer (especially if you haven't profiled your monitor using a product such as Colorvision's Spyder hardware and Optical software [see the review on my site: http://www.bythom.com/colorvision.htm]), but the color is more representative of what you'll see in final prints.

The **Color Mode II** (AdobeRGB) Color Space on the D80 appears to be fairly accurate; the other two options are slanted a bit towards inaccurate but pleasing colors. Specifically, **Color Mode I** (sRGB) is skewed towards producing pleasing skin tones, and is most suited for use in pictures of people. **Color Mode III** (also a sRGB variant) is skewed towards more saturated colors, especially in the greens, and is more suited for use in landscape and scenic photos.

Unfortunately, it's not just a simple matter of setting the camera's Color Space using the options on the SHOOTING menu (more on that in a bit, too). Instead of embedding the actual Color Space information, as is often done in graphic design firms with their files, all that choosing a Color Space via the **Color Mode** option does is place a marker in the EXIF data as to what the camera is set to, and changes the position of the _ in the filename. And a lot of software ignores that

marker or the filename change! Here are some of the things you're not told in the D80 manual:

- *Set your working Color Space in all your software programs to match what you use in the camera*. Any good digital editing software, including Nikon Capture NX and Photoshop CS2, has an option (usually in the **Preference** or **Color Settings** menu item) for setting the Color Space the program uses to display values. Make sure that you set this! Your Color Space choice in your software programs should match the camera setting you choose.
- *Learn whether your program recognizes the tag and filename change or not*. For the most part, JPEG files are automatically recognized as being sRGB by most software, regardless of the camera's chosen Color Space. That's probably because the software engineers simply followed the original EXIF specification, which used to state that any EXIF file is in the sRGB Color Space [137]. If you use AdobeRGB, you may have to set your program to *ignore or discard* the Color Space, or *assign* the correct one.
- *NEF output often works a bit differently*. Nikon Capture NX assigns the correct Color Space and *attaches the color profile information* to the TIFF and Photoshop PSD files it outputs (assuming that you've set the program's preferences correctly). In other words, it actually passes a real color profile to other software rather than assume the software understands the Color Space by file name or EXIF data methods.

Note: *I used the words* color profile *in that last bullet. So what's a color profile? It's a description of how a device deviates from (or adheres to) a Color Space definition. In essence, a color profile defines both the Color Space used and tells software how the device's data may deviate from the*

[137] The latest EXIF standard allows for two file naming conventions, each of which defines a different Color Space. A `DSC_####` file would be sRGB, while a `_DSC####` file would be AdobeRGB. Unfortunately, not all software has caught up to the EXIF standard changes. (Photoshop Elements and CS2 have, by the way.)

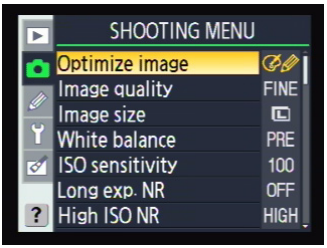
precise definitions expected by the Color Space. That's one reason why "profile" and "space" get so mixed up in descriptions of color.

If you have doubts about whether you've got the right settings in each of your programs, shoot a standard color reference in known lighting with the proper white balance setting, such as the GretagMacbeth ColorChecker chart in sunlight with the camera set to the **Dir. sunlight** white balance setting. Then watch for shifts in color as you bring the resulting image through your workflow. If your monitor is calibrated correctly and your programs set to the right color space settings, you shouldn't see *any* color shifts from original to on-screen final version [138].

Setting Color Spaces (Color Modes) in the Camera

To set the Color Space your camera uses:

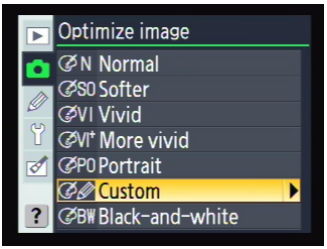
1. Press the **MENU** button to see the menu system.
2. Use the Direction pad to navigate to the SHOOTING menu (the green camera tab).
3. Use the Direction pad to navigate to the **Optimize image** item and press the ▸ key on the Direction pad or the **OK** button to select it.



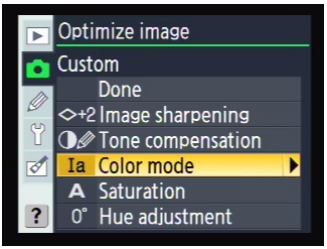
4. Use the Direction pad to navigate to the **Custom** item and press the ▸ key on the Direction pad or the **OK**

[138] Don't expect the camera's color LCD to show color shifts, though. It is not calibrated in any way, and does not show an accurate representation of the color of an image.

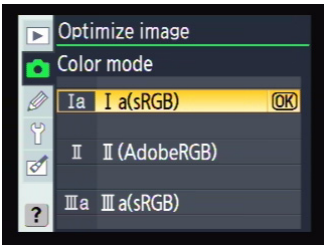
button to select it.



5. Use the Direction pad to navigate to the **Color mode** item and press the ▸ key on the Direction pad or the **OK** button to select it.



6. Use the Direction pad to navigate to the **Ia**, **II**, or **IIIa** and press the ▸ key on the Direction pad or the **OK** button to select it.



Setting Color Spaces and Profiles in Your Software

As noted earlier, simply setting a Color Space in camera isn't always enough to get perfect color. You also have to set the Color Space in your software.

Moreover, slight variances in device abilities can cause them to deviate from the defined Color Space. Thus we often "profile" a particular device. That's exactly what we do with our monitors when we use a calibration tool such as Colorvision's Spyder.

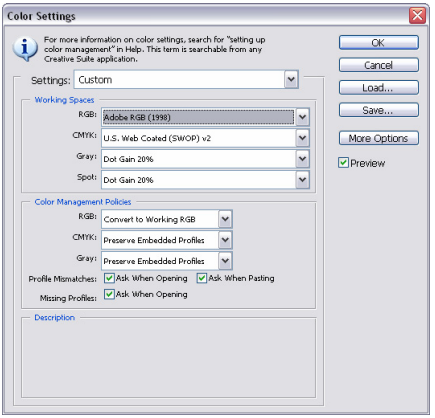
Color Profiles are where color management gets a bit confusing. For example, when you calibrate your monitor with Colorvision's hardware or software (or any of the alternative choices—I use Colorvision as an example because its low price and decent quality make it a good match for most D80 users), what happens? Well, Colorvision's software alters information that your video driver uses to send signals to your monitor. For example, if the Colorvision Spyder detected that your monitor wasn't producing enough blue, it would alter the video driver to produce "more blue" in colors sent to the monitor.

However, the video driver changes only occur for what I'll call "color aware" programs (on Windows; virtually all Macintosh programs use the value set in ColorSync and are automatically color aware). Photoshop, for example, is color aware and the profiled monitor settings the Colorvision makes and installs are used when you're viewing pictures on your display.

You do have to set some values in your software programs, though. Let's start with Photoshop and Color Space settings:

1. In Photoshop, select **Color Settings** from the **Edit** menu.
2. On the pop-up for **Working RGB**, select **AdobeRGB** (or the Color Space you set on the camera).
3. Under **Color Management Policies**, select **Convert to Working RGB** and check all the boxes that begin

with **Ask**…



Other programs pose different color management problems and may require you to make additional settings.

Fine Tuning the Color

In this abbreviated color management lesson we only *profiled* the monitor. In general, once you've done this and set your working Color Spaces in your software correctly, you should be able to take a picture with known colors in it and follow it all the way through to print without seeing any major deviations.

Note the word "major" in the last sentence. If you *do* see a big color shift, something isn't right and you shouldn't try to profile any device until you've corrected whatever's wrong. It might simply be that you got the white balance wrong while shooting or selected a non-default paper while printing. But major deviations of color at this point would indicate that you've set something wrong or haven't correctly profiled your monitor (or have dueling profiles, as was previously discussed.)

If you *can* follow color from camera to print and get good results, you may see very minor color shifts that you want to correct. My advice: isolate whether the shift occurs camera-to-computer or computer-to-printer. If you see both, work on the camera-to-computer side first.

You should be able to shoot a known color source, such as the GretagMacbeth ColorChecker chart using a custom white balance and see the correct colors on your monitor. I haven't seen differences in color rendering between different D80 (and especially at higher ISO values), so I generally don't find that profiling the camera is useful, as even small white balance issues will more grossly affect color than individual camera variation. Thus, camera-to-computer color shifts are almost always the result of incorrect settings on your computer software (e.g., Color Space doesn't match what the camera set).

Once your camera-to-computer color issues are resolved and you get repeatable, accurate results, then and only then work on the print side. First, examine all the options for your printer driver and make sure that one of those doesn't "fix" your problem.

More often than not, selecting the right paper and ink choices are all that it takes (on Epson inkjets using Epson papers). If you use custom papers or inks, you may have to profile your printer, which is out of the realm of this book (but do go to http://www.inkjetmall.com and look at their paper/ink/profiles; these are as accurate as you can make on your own).

Another thing to look for is that only one program or driver is doing the color correction for printing. If you print from Photoshop, for instance, it's possible to set your system up so that both Photoshop and your Epson print driver are both trying to handle color correction. Check the various Epson printing articles on Michael Reichmann's site (http://www.luminous-landscape.com) for some help in dialing in the right options so that only one program is managing color.

Tip: ***Advanced users only.*** *Technically, the sensor of the D80 doesn't have a Color Space, because it should "capture" any color of light that hits the photosites within the spectral range that it allows through. (It would need a Color Profile,*

though, because there may be some anomalies in the capture process)

Many pros believe that if you shoot raw files (NEF), you should use the largest possible Color Space possible when working on those images. That would be ProPhotoRGB. Indeed, many pros set their raw conversion software to this Color Space in order to preserve every last bit of color accuracy and subtlety. (You don't need to, and can't, set the camera to this Color Space, just your software. But that only works for NEF files.)

In practice, though, most amateurs needn't go to that trouble (ProPhotoRGB chews up computer memory and will slow you down, amongst other things), as the Epson inkjets most people typically print with won't reveal any tangible differences. That's because the Epson printers have a Color Space very similar to AdobeRGB. Still, even the Epson printers do have a bit of color ability that's outside the AdobeRGB space, so if you're into getting the maximum possible quality, you might want to explore ProPhotoRGB.

Special Lighting Issues

UV and Infrared

Most of the visible light spectrum seen by humans is between 400 and 700 nanometers (nm) in wavelength. Very roughly speaking, blue pixels are generated from information in the 400 to 500nm span, green pixels from the 500 to 600nm area, and red pixels from data in the 600 to 700nm range. Yet, over half the light (energy) that reaches our planet's surface is outside this limited spectrum. At the low end, you'll find ultraviolet light, while at the higher wavelength values lays the infrared.

The D80's sensor is barely sensitive to light outside the visible spectrum. Each successive Nikon DSLR seems to be less responsive to UV and infrared, and the D80 and D200 are the least sensitive to date. Thus, the D80 isn't the best candidate for either type of shooting—the D100 is much more responsive to these light ranges than the D80. That's not to

say that you can't use a D80 for UV or IR photography, but expect to get very long exposures when you do so.

Ultraviolet

Most glass used in lenses does a poor job of transmitting ultraviolet light through to the imager. That, coupled with the low sensitivity to ultraviolet of the sensor makes taking ultraviolet images difficult, though not impossible.

Nikon made a special lens, the 105mm UV Micro-Nikkor f/4.5, specifically for lab work that needed a lens that efficiently passed low wavelength light to the film plane (and also did so without needing focus adjustments). Couple this lens, which passes 70% of the light from 220 to 900 nanometers, with a filter that blocks the visible spectrum and you can take some very interesting pictures.

Indeed, one Scandinavian photographer, Bjørn Rørslett, has specialized in doing just that (see http://www.naturfotograf.com/index2.html). Coupling a Hoya U-360 filter that blocks the visible spectrum with a Tiffen Hot Mirror filter to hold back the infrared spectrum slightly, he takes what he calls "invisible images" using his Nikon bodies. (You can also use a Nikon FF or a Wratten 18A to block visible light, by the way.) Note that if you try to duplicate his work with a regular lens, you'll find that exposure times are exceedingly long on a D80 (as I noted earlier, most glass in regular lenses isn't very efficient in passing ultraviolet light, and the D80 isn't very responsive to UV, either). You may have to fiddle with focus adjustments, as well (lenses are generally optimized to focus only the visible spectrum at the film plane). If you really get into UV photography, note that Nikon made a UV lens, the 105mm UV Micro-Nikkor f/4.5, and a UV flash, the Speedlight SB-140, which, though hard to find, would allow you to take your experiments indoors, as well.

Still, the bottom line is simple: if you're really into UV shooting, get a different Nikon DSLR, preferably one of the first generation models (D1 series or D100). As Bjorn notes in

his review of the D200, it just isn't very responsive to UV, making using it for such work very frustrating, at a minimum. The D80 uses much the same sensor and filtration, so is just as bad as the D200.

Infrared

At the other end of the light spectrum, the D80 does a marginally better job at the near infrared spectrum.

Most photographers associate infrared images with the grainy, moody black and white photos generated by Kodak's old infrared film. You can duplicate those with your D80, too. Typically, you'd place a Wratten 89B filter on your camera (and later use Photoshop to make the conversion to grayscale).

The D80's meter is somewhat inaccurate for near infrared photography (white balance should be set normally), so you may want to bracket until you find the right exposure for the filter you use. Since you're filtering out a fair amount of light and have a camera that isn't terrifically receptive to near infrared, you'll certainly end up with tripod-inducing shutter speeds. The Hoya filter I use removes virtually all the visible spectrum, and I find that I have to add significant exposure to what the meter recommends, and end up with exposures measured in seconds no matter what aperture and ISO I use.

If you want to duplicate the grain aspect of Kodak's infrared film, set one of the two highest ISO values on your camera with noise reduction set as low as you can make it—the D80's noise pattern is relatively chroma free, so you'll get a grainy-type of rendering that's very appropriate.

The exact wavelength at which light is filtered varies considerably in filters labeled as "Infrared." The visible spectrum ends at about 780 nanometers (and the near-infrared is usually said to start at that point), but "infrared" filters are available to start filtering anywhere from 610 to 1000 nanometers. To add to the confusion, different filter

makers use different designations for the filter point. Here's a table of some of what's available:

Filter	*Cutoff*	*Manufacturers*
RG 610	610 nm	Heliopan
RG 630	630	Heliopan
RG 645	645	Heliopan
RG 665	665	Heliopan
RG 695	695	Heliopan
89B,BW092	710	Kodak, B&W, others
RG 715	715	Heliopan
88A		Kodak, others
87,RG 780	780	Heliopan, Kodak, others
87C,RG830,BW093	830	Heliopan, B&W, Kodak
RG 850	850	Heliopan
RG 1000	1000	Heliopan

Tip: If you want the false-color infrared associated with Kodak's near-infrared slide films, you can use another technique: stack polarizing filters!

If you're an infrared junkie, you probably would like to get rid of the hot mirror filter over the sensor and replace it with a visible spectrum blocker (like the above filters). This would let you use the camera almost normally, but the camera would *always* take near IR pictures instead of visible light pictures (i.e. once converted, the camera isn't usable for normal photography).

Well, if you want to throw caution to the wind, you can make such a modification: http://www.lifepixel.com has the details on how it's done, but note that this is major surgery and, done incorrectly, will render your D80 useless. Fortunately, they also offer a modification service. I had one of my D70's converted this way, and carry this extra body with me when I want to do infrared photography. Here's what a picture taken with my converted camera looks like:

Iguasu Falls, Argentina. I've pulled the little bit of color out of the original IR image to make it strictly a black and white image, but otherwise haven't done any other processing. Note how the blues (sky, river) have gone dark, while the greens (foliage) have gone white.

Shooting Under Fluorescent Lighting

Fluorescent lighting makes it particularly difficult to photograph well. Not only is the method used to create the light different than most other light sources, but also there is considerable variance between fluorescent tube manufacturers.

Heat produces the light emitted by the sun, incandescent bulbs, halogen bulbs, and most other sources. Heat-generated light has the property of emitting a continuous spectrum of colors, though the balance of these colors is different for various sources (which is one reason why the white balance setting for sunlight is different than for incandescent light, for example). Another property of most light emitters is that their color balance is relatively stable (e.g. two brief measurements of color temperature taken a second apart would be virtually the same).

Fluorescent lights are neither heat-produced nor color stable. Fluorescent light is produced by periodically striking an ultraviolet arc. The arc is on for about 2 milliseconds, then decays for 2 to 3 milliseconds, then is completely off for 3 to 4 milliseconds; this pattern repeats approximately 120 times a second (in the US; 100 times a second in the UK and Europe, or double the AC frequency). The arc, in turn, excites colored phosphors within the tube, which are what actually emit the visible light. Unfortunately, red, blue, and green phosphors react in differing fashions to the triggering arc. Green phosphors, for example, tend to react quicker and decay slower in reaction to UV triggers, while red phosphors are slow to react and decay quickly.

If you take photographs with shutter speeds faster than 1/125 either early or late in a fluorescent light's cycle, your images show an additional green cast. If you take photographs at shutter speeds faster than 1/125 midway through a fluorescent light's cycle, resulting pictures tend to get an additional magenta cast. That's in addition to any overall cast the tube may have (again, fluorescent color balances vary from manufacturer to manufacturer). Thus, there are two rules to follow when shooting under fluorescent light with a D80:

- *Use Preset White Balance to set the overall color balance*. If you shoot under the same lighting all the time, shoot a Macbeth Color Checker chart under the lighting using all variants from –3 to +3 for fluorescent white balance, then examine the neutral gray patches for color casts; if one of the variants has little or no color cast, use that white balance setting in the future. Better still, use one of the dedicated white balance presets to record the actual value and name it for the venue.
- *Shoot only at shutter speeds that are multiples of 1/120* (e.g. 1/125 [139], 1/60, 1/30, 1/15, or in Europe 1/100, 1/50,

[139] I've had people report to me that even 1/125 isn't always safe (the shutter speed *should* be 1/120 to match the AC frequency in the US). I haven't had problems with this shutter speed, so I suspect that it has to do with the specific fluorescent bulbs encountered.

1/25). Never use shutter speeds faster than 1/125 (or 1/100 in Europe). Shutter speeds that are not multiples of the AC cycle means that you don't get complete color decays from one or more of the phosphors.

Other Field Shooting Issues

Keeping the sensor Clean

Probably the most difficult aspect of using a D80 in the field is keeping the sensor clean. To minimize the need to clean the sensor, you should:

- *Minimize lens changes, especially in dusty environments*. Each time you change lenses, you expose the mirror box area, and ultimately the sensor, to the elements.
- *If you can, change lenses with the front of the camera pointed downward*. Dust settles downward, thus if you point the front of the camera upwards while changing lenses, you increase the possibility of dust getting into the mirror box.
- *Keep the camera in the bag*. Assuming you keep your camera bag clean, each ring of protection you can put around the D80 can decrease the chance that dust gets anywhere near the sensor. In dusty Africa, when I'm not using a camera body, I put it in a plastic bag (with the air removed), and then place the plastic bag in my camera case. Then I put my coat over the camera case. I also make sure that the sensor orientation during travel is downwards, so that any dust already in the camera settles on the back of the shutter, not the sensor.

Dust appearance in images is aperture related. At very large apertures (e.g. f/1.4), you won't see the dust in your images. At small apertures (e.g. f/32), it often appears as a nearly in-focus black dot.

Still, even with the utmost care you may find that the sensor collects dust. To examine your D80's sensor for dust, use one of these methods:

- *Take a picture of an evenly lit surface* (like a wall or the sky) at the lowest ISO value using the smallest available aperture (e.g. f/22). Examine the resulting image carefully on your computer at 100% size, looking for dark spots. Some D80 users run the resulting image through

Photoshop's **Auto Levels** command, which tremendously exaggerates the dust pattern.

- *Set the camera to Bulb* (or a 30 second exposure). Remove the lens and trip the shutter so that the mirror moves out of the way. Shine a light into the mirror box so that you can see the surface of the filter that sits over the sensor (tip: use an LED headlamp, like those sold at camping stores). Significant dust can usually be seen using this method, but most of the smaller stuff is beyond your ability to see (to put size in perspective, several hundred photosites would occupy the space on this -).

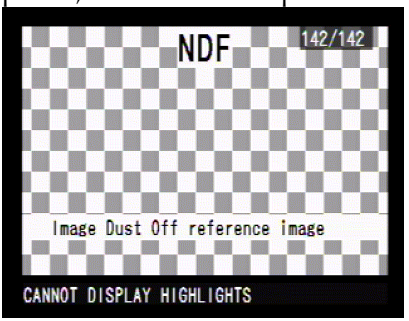
If you use Capture NX (see "Nikon Capture NX" on page <620>), it is possible to use what Nikon calls a "dust reference photo" to perform a software "dust removal." Here's how it works:

1. Before taking your photos for a session, make a dust reference photo. Make sure the camera has a lens on it that has a CPU (i.e. no manual focus or older non-D-type autofocus lenses).
2. Press the **MENU** button to see the menu system.
3. Use the Direction pad to navigate to the SET UP tab (wrench icon) and the ▸ key on the Direction pad to enter the SET UP menu.
4. Use the Direction pad to navigate to the **Dust off ref photo** option and press the ▸ key or the **OK** button to select it.

5. Use the Direction pad to highlight **On** and press the ▸ key or the **OK** button to select it.

6. Follow the instructions on the display, which instruct you to take a picture of a white object (card or sheet of paper) 10cm (4″) from the front of the lens. Fill the frame with this object.

7. Press the shutter release. If you get the message **INAPPROPRIATE EXPOSURE CONDITIONS** followed by the instructions in Step 6 repeated, the image wasn't good enough; make sure that you've got enough light and are only seeing the white card and try again. Otherwise, you'll end up with a reference photo, which shows up like this on playback:



8. When you edit your image using Capture NX, make sure the **Dust Off** tool is enabled in the **Base**

Adjustments/Raw Adjustments section and that the tool points to the proper photo (click the **Change** button if you need to point it to a different reference photo).

While not perfect, this function does work well enough to keep your cloning and post-processing fixes to a minimum, but it's not a replacement for sensor cleaning. You're sacrificing some detail using this function *and* dust will continue to build up on the sensor, which means that, short of taking a reference photo for every image you make, it may not correct every defect. Moreover, at some point there will be a dust particle that resists being corrected in this fashion. I should also point out that the Capture NX tool has a maximum number of dust particles it can fix; once your sensor gets past certain "dustiness," you'll find that Capture NX refuses to correct images.

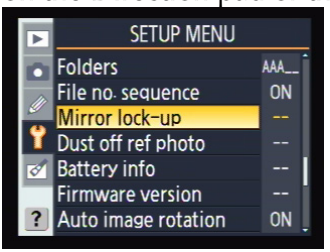
Assuming that you have dust on the sensor, there's not a lot else you can do about it in the field (trying to remove the dust in an environment where dust may still be present can prove to be a very futile endeavor). So the dust reference photo technique is worth using as a stop-gap measure until you can get back to an environment that is more conducive to cleaning.

Note: If you see dust in the upper left corner of your image, the actual dust is in the lower left corner of the sensor as you face it.

If you're in a reasonably clean environment and have an EH-5 AC adapter or a fully charged battery, to clean the sensor [140]:

[140]A slightly more elaborate description of sensor cleaning is on my Web site at http://www.bythom.com/cleaning.htm. There I describe the two commercial methods I use here—Sensor Brush and Sensor Swabs—but do-it-yourselfers can create their own versions of each. For a brush you need a soft nylon brush that is free from additives and glues (try makeup counters and art supply stores). For a swab support, use a narrow Rubbermaid spatula cut to size or a soft plastic or wood stick (I use artist palette knives found at a local art store). The swab material needs to be lint-free,

1. With the camera **OFF**, if you're going to use AC power plug the EH-5 adapter into the camera (and into an AC wall socket. Better yet, use an UPS [*uninterruptible power supply*]).
2. Remove the lens.
3. Turn the camera **ON**.
4. Press the **MENU** button to bring up the menu system.
5. Use the Direction pad to navigate to **Mirror lock-up** on the SET UP menu (the wrench tab). Press the ▸ key on the Direction pad or the **OK** button to select it.



6. Use the Direction pad to navigate to **On**. Press the ▸ key on the Direction pad or the **OK** button to select it.

7. Hold the camera so that dust won't resettle on the sensor or back in the mirror box.
8. Press the shutter release to raise the mirror and open the shutter curtain, revealing the sensor.

soft material, such as the PecPads you get when you buy Eclipse solution. However, do-it-yourselfers should read the disclaimer on the Copyright page (i.e. I won't be responsible for damage to your camera). The commercial solutions work well, and in the case of Sensor Swabs, there's a damage-free guarantee that's worth noting.

9. Use a manually powered bulb blower to blow out any large chunks of grit (usually hairs).
10. Use a Sensor Brush to swipe across the sensor area (remember to "recharge" the brush before each pass using compressed air)

    or

    If the problem area doesn't come off with brushing, then use a Sensor Swab and Eclipse (methanol) solution (see http://www.photosol.com) [141].
11. Turn the camera **OFF** via the main power switch. The shutter curtain should close and the mirror should return to its normal position.
12. Remount the lens on the camera.
13. Unplug the EH-6 AC adapter.

Note: Anecdotal evidence seems to indicate that dust is more easily removed from a cold sensor. I wouldn't advocate putting your D80 in a refrigerator prior to cleaning, though, as condensation becomes an issue. It probably is wise to avoid cleaning the camera immediately after it has been used, though, as the components are probably still warmer than the surrounding environment. Also, if you can postpone a cleaning until you're in a cooler environment (e.g. an air-conditioned building in warm climes), you'll probably find it easier to clean your sensor.

If these methods fail to remove the dust, you'll need to have a Nikon service center clean your camera. Remember, Nikon specifically disclaims use of any method that touches the filter array on top of the sensor. I'm describing the methods that most of us pros have resorted to because we simply can't

[141] Yes, Nikon's documentation says don't touch the sensor. But Sensor Swabs are similar to the method they use to clean the sensor. Heck, they even sell sensor cleaning kits in Japan. Don't get the cloth too wet [you'll leave streaks], and don't use force in cleaning [you could grind dirt into the filter face or break the filter]. And, again, I won't pay to have your sensor replaced if you use this technique and damage your camera. If you're not comfortable using this technique at your own risk, then don't use it.

keep returning the camera to Nikon for cleaning every time our sensors get dirty (we'd never have use of our cameras!).

Caution: If you use **Mirror lock-up** *with a fully charged battery, the camera will start to shut down when battery power reaches three bars in the top LCD indicator (a full battery shows five bars). In theory, the camera beeps and blinks the AF Assist lamp to warn you that it needs to close the shutter. Nikon's manual claims that you'll have about two minutes from the first warning until the shutter actually closes. I think that in practice, the warning is closer to the actual shutter close. I find that the shutter consistently closes in a bit less than 90 seconds on my D80, and it could be battery dependent (i.e. a battery that doesn't hold 100% charge but only 90% when fully charged would act differently).*

Personally, I will only use battery powered mirror lockup for cleaning as a last resort, and then only after thoroughly charging a battery. The risk is that you still have your cleaning tool inside the camera when the shutter tries to close. This will dislodge the shutter blades, rendering your camera inoperative. While I lobbied for this feature to be added to the camera, I repeat, it's a last resort option because of the increased risk of damaging the camera. Use it at your own risk.

Toppling a Myth

Dust clings to the filter array in front of the sensor not so much because the sensor puts out a static charge, but more because of the laws of gravity and surface tension. If you store your D80 on its back, gravity will have its way, and as the inevitable dust in the air settles, it'll settle downwards onto the filter surface. If you store the D80 on its bottom, the sensor still manages to "grab" a few small dust particles due to the mechanics of surface tension. Generally, dust that sticks to the filter this way is easily removed with light bursts of plain air (the blower bulb). If possible, the best storage position for a D80 is lens-mount down.

Worst Case Scenario

Many years of experience with digital SLRs in the field has led me to this conclusion: humidity changes are your worst enemy when it comes to dust.

What happens is one of two things: (1) any slight dampness (condensation) on the filter will tend to increase the surface tension dynamics and literally suck dust right up to the filter; or (2) dust already on the filter gets a light condensation on top of it, which "welds" the dust to the filter.

Either way, when the humidity lowers and the water vapor dries up, it tends to act as a "sealing coat" on top of the dust. In really bad conditions you may even see a faint ring (dried water) *around* the dust spot on your images (I call these dust zits). This kind of dust problem is very difficult to clean, as you have to use both strong wetting and some pressure to remove them. I learned this one the hard way by coming down from the cold dry air at 10,000 feet on a Hawaiian volcano to the warm moist air in a garden at sea level in the space of an hour. Not only did it take another couple of hours to rid the condensation out of my lenses, viewfinder, and elsewhere, but it was as if I had baked the dust onto the filter. It took me several tries to get the dust off.

Panoramas

To get perfect "stitching" of the multiple shots taken for a panorama, you must first correctly position the rotation point of the camera. The location of this rotation point is not the film plane or the tripod socket. It's the point where the light rays converge before inverting themselves on the way to the film plane. If you know this "entrance pupil distance" (often incorrectly referred to as the "nodal point" of a lens), then you can easily calculate the proper rotation point. Note that the D80 normally would rotate around the tripod socket, which is a few millimeters in front of the film plane. But with most lenses, the actual point around which you should rotate is still further forward. With the 18-135mm f/3.5-5.6G DX lens, the point is somewhere under the zoom ring; exactly where is depending on the focal length used.

Tip: *For information for some lenses, see http://www.swissarmyfork.com/lens_table_1.htm.*

Temperature Considerations

Several temperature-related issues when using a D80 should be noted:

- *Image noise increases with heat*. With long exposure times in hot climates, you'll sometimes see some random bright pixels in your images ("hot pixels" [142]). If you shoot in hot climates, you might want to look for ways to keep the D80 cool. Be careful of introducing condensation problems by moving the D80 from very cool to very warm conditions, however. If the temperature is over 80°F (27°C) and you shoot images at 8 seconds or longer, consider turning the **Long exp NR** function **On** (SHOOTING menu). This captures the noise pattern and subtracts it from your image.
- *Batteries don't like cold*. Lithium-Ion batteries such as the ones the D80 use *do* have decent cold weather performance, but it's still possible in extreme cold for the battery to fail quickly. Keep a fully charged spare warmed up in an inside coat pocket and swap batteries as needed.

Humidity

Nikon's manuals have several warnings about exposing the camera to high levels of humidity. If you live in a humid climate, it is probably wise to store the camera in a cool, dry area, or with a desiccant in a plastic bag from which the air has been removed.

Changes in humidity can play a part in sensor cleanliness, as I've already noted. When condensation forms on the filter, it tends to trap dust particles. Moreover, you can get small "water rings" on the sensor. In general, it pays to be careful

[142] A "hot" pixel is one that is simply stuck, while a "dead" pixel is one that is totally non-responsive.

when moving the camera from warm to cold or cold to warm environs, especially if there's any moisture present in the air.

The trick with dealing with temperature and humidity changes is to remove the air surrounding the camera. Place the camera body in a zipper lock bag and remove as much of the air as possible before sealing it (same with each of your lenses).

White Balance Settings

With Nikon Capture NX (and other raw conversion programs that understand the D80's encrypted white balance information), D80 users who shoot NEF format images can retroactively apply white balance settings to an image, so many tend to think that they can ignore white balance completely.

White balance intersects with other digital imaging color issues on a D80. First, the photosites covered with blue filters are effectively less sensitive to light than the green or red ones. In low light conditions, this can be troublesome, especially if you're shooting in a situation where little or no blue wavelengths are present in the first place. At one extreme, you get noise in the channel that has little light energy hitting it; at the other end you can get a blown channel because too much light hit it. Since the histograms are created from the embedded JPEG in NEF images and the camera's white balance setting is used for that JPEG, setting a "wrong" white balance can produce misleading histograms. If you shoot NEF images, use the correct white balance setting or at least a white balance of **Auto**.

Second, many of Nikon's choices for white balance settings are slightly suspect—either Nikon knows something about the photosite sensitivity and color rendering that they haven't told users about, or they've chosen values based upon visual

review, or the actual color temperature values reported in the manual are inaccurate [143].

Consider the following table:

White Balance Color Temperatures

Lighting	D80	Film	Likely*
100-watt incandescent	3000K	3200K	2900K
Sunny daylight (noon)	5200K	5400K	5400K+
Overcast	6000K	5400K	7000K+
Flash	5400K	5400K	<6000K

** Source: Nikon Field Guide, typical color temperatures*

Using Nikon's defaults (either in the camera or after the fact with Nikon Capture NX) tends to produce slightly warm (red) indoor color, and a slightly cool (blue) outdoor color. Outdoors, most Nikon users tend to use a **-1** or **-2** adjustment to the named white balance setting they're using (e.g. **Cloudy -1**). Indoors, many just let the camera do its thing, as a bit of warmth is usually preferred.

Personally, I like having a reference setting, regardless of how I set my D80. With a reference, I can use Photoshop's color controls to correct any remaining bias. How do you establish a reference? I carry a Kodak gray card and a GretagMacbeth ColorChecker with me whenever possible, and I take a shot with both cards in the scene whenever the lighting changes significantly (it's okay to take this shot using **JPEG FINE**, by the way—it's one way I identify my color check file, since all the other files have NEF versions). If I want to use **Pre** white balance, then I set it using the gray card.

Of course, you don't *always* want to correct for color temperature! One reason why sunrise and sunset scenes look red (or orange) to us is that the color temperature is extremely warm, approximately 3100-3600K depending upon the exact timing of the shot and atmospheric conditions. We perceive it as warm because the change occurs so rapidly (prior to

[143] Or, I suppose, they could have just gotten it wrong.

sunrise the color temperature may be 7000K or higher) and the blue wavelengths are generally filtered out by the extra atmosphere the light has to get through. In such cases, you'd want to set the camera's white balance to **Dir. sunlight** and shoot normally, lest you lose the very aspects of the light that intrigued you in the first place.

But probably the most difficult white balance situation to deal with is mixed sources that include frequency-based lights (fluorescent, mercury vapor, carbon arc, etc.). As I noted earlier, you need to set your shutter speed to match frequency-based lights (e.g. 1/60 for fluorescent lights in the US), lest you introduce color errors due to phosphor decay. But that may not be enough. Ask yourself these questions:

- *Which lighting type dominates?* In mixed source situations, try turning the sources on one at a time and taking a meter reading. One source is likely to dominate, and that should usually be the one you use as your base white balance setting.
- *Can you overpower the lighting?* A strong flash comes in handy in mixed lighting situations, as you can often make your flash the primary light source (at least if your subject is less than 20 feet (~6m) away. In this case, make flash your white balance setting. Your subject will look correct, but the background may now look very wrong because it's lit by another light source (incandescent would produce orange backgrounds, fluorescent an obnoxious blue green). That's one reason why most location photographers use multiple light setups. They either turn off the background lighting or they overpower it. With multi-flash TTL now possible, I tend towards turning off the source lighting and using my own, if possible. Three SB-800's and the internal flash can light a pretty large area plus subject.
- *Will a filter balance errant color?* If the problem is a mix of flash and fluorescent, or even incandescent and fluorescent, the primary problem is the fluorescent light. Try using an FLD filter (or a 30M), as the primary problem

with most fluorescents is going to show up as too much magenta. With mercury vapor in the mix, you want to cut out red, so a 30R should be tried. (Anything more than 30 units of filtration starts to become a major problem with the other light sources; indeed, I'd probably try 10M or 10R first.) Many professional photographers carry filter gels for their flash—essentially they try to filter the flash that they *add* color to the scene to match that of the existing light so that a **Pre** white balance works better.

If you've got an SB-600 or SB-800, you can get a mini filter set for the flash that helps. In this case, you set white balance for the ambient lighting and then pick an appropriate filter for the flash head so that it (nearly) matches the ambient (the amber filter for incandescent, the green filter for fluorescent).

- *Are the lighting sources lighting distinctly different areas of the scene?* If you are using flash to light the subject and fluorescent is lighting the background, you can sometimes use Photoshop's layering to select the background and color correct it after the fact. In short: set up the shot so that you have distinct areas that can be selected and color corrected.

After You've Taken Pictures with your D80

While most digital image editing issues are outside of the scope of this book, in this section I'll present an overview of Nikon's software for the D80, along with a brief description of a few third-party products. We'll also step through handling images from camera to print.

Things You Do After the Shot is Taken

You've followed my advice so far and now have a Secure Digital card full of images you've shot. What's next?

The primary things you do with your images boil down to:

- *Transfer them to your computer.* Because your images are digital, they fit right into the computer world, at least once you get them there. On your computer, you can modify, annotate, email, and print your images, amongst other things. Your computer in essence becomes your image scrapbook and your desktop darkroom. See "Transferring Your Images to Your Computer" on page <573> and "D80-related Software" on page <604>.
- *Print them.* That's what you used to do with your film images, and you can do the same with your digital images. You don't need a computer to print your images, by the way—plenty of other methods exist, including direct from camera to printer (PictBridge). See "Printing Your Images" on page <578>.
- *Show them.* The D80 has the ability to present a slide show of images, and it further has the ability to present this slide show on a television monitor. See "Slide Shows" on page <593>.
- *Modify them.* The D80 has a number of in-camera features that allow you to modify images you've already taken. See "The Retouch Menu" on page <552>.

We'll tackle each of these things individually in this section of the book.

The Retouch Menu

Nikon has made an interesting addition to the D80: the RETOUCH menu. This menu allows you to make a number of changes to your images, *after you've taken them.* Normally, you'd use a computer and a photo editing program—such as Photoshop—to make changes to your images, but the D80 brings a set of basic editing tools to the camera.

Before I get to describing each of these tools, let me give you a word of advice: for the most part, I'd tend to avoid them. The primary reason is that the color LCD on the camera is just too small and inaccurate to make critical image post processing decisions. The good news is that the camera always creates a new image while making changes, leaving your original intact, but if you still have to end up using that original to make fine-tuned changes, well, I don't see that you've gained anything by doing a "quick-and-dirty" edit in the camera.

You might wonder about what happens to EXIF data when you create these new images from existing ones. Simple: the camera copies the EXIF data from the image being used (in the case of **Image Overlay**, from the first image). It also adds another EXIF data point indicating the type of retouching done and a new image review page that contains that data:

Okay, you've decided that you want to explore the camera's image manipulation capabilities anyway, so let's look at the options one by one.

D-lighting

Nikon uses the trademarked term "D-lighting" to describe a process whereby the tonality in the shadow areas of an image are changed to show more detail. It's similar in action to Photoshop's **Shadow/Highlight** function, though the camera's built-in version only impacts the shadow areas (highlights are maintained as is).

D-lighting is also a function in Nikon Capture NX. Capture NX has additional options and setting flexibility that the camera does not (another reason for not performing this function in the camera).

To use D-lighting, you must first take a picture. That picture needs to be color (i.e., you can't apply this to black and white images shot with the D80), and can be NEF or JPEG. D-lighting's effects will be more obvious with underexposed images or images with large darker areas of exposure.

1. Press the **MENU** key to show the menu system.
2. Use the Direction pad to navigate to the RETOUCH menu (paintbrush icon tab) and press the ▸ key on the Direction pad or the **OK** button to enter the menu.
3. Use the Direction pad to navigate to **D-lighting** and press the ▸ key on the Direction pad or the **OK** button to select it.

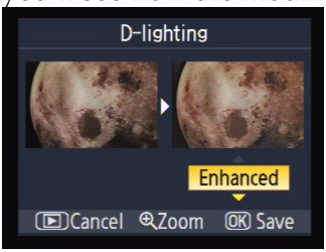
4. You'll be presented with thumbnails of six images at a time.

   a. Use the Direction pad ◀ and ▶ keys (or Rear Command dial) to navigate to the image you wish to work with.

   b. Use the Zoom In button (🔍) to see the currently selected image in full screen size.

   c. Press the **OK** button to select the image you wish to change.

5. The camera now shows two examples of the image. On the left you'll see the original, while on the right you'll see how the modified image appears.



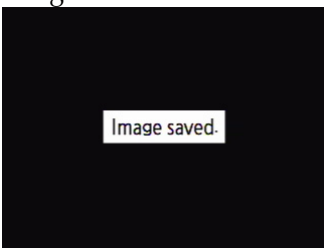
   a. Use the ▲ and ▼ keys on the Direction pad (or Rear Command dial) to change the level of D-lighting you wish applied: **Normal**, **Moderate**, **Enhanced**.

   b. Use the Zoom In button (🔍) to see the modified image in full screen size.

   c. Press the ▶ button to cancel the process and *not* create a modified image.

   d. Press the **OK** button to start the creation of the modified image.

6. After pressing the **OK** button in Step 5, the camera will display an hourglass icon for a moment to indicate that it is creating a modified image according to your instructions. After a few moments, you'll see an **Image Saved** message and be returned to normal image review.



The modified version of your image will appear with a special icon (paintbrush):

Red-eye correction

A better method than using the red-eye reduction function on the flash (see "Setting Flash Options" on page <458>) is to remove red-eye after the fact. Red-eye correction is also a function in Nikon PictureProject and Capture NX, so you don't need to perform this function in camera.

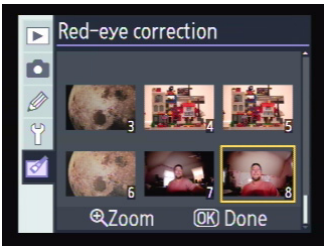
To use **Red-eye correction**, you must first take a picture *using flash*. That picture also needs to be color (i.e., you can't apply this to black and white images shot with the D80, nor can you apply it to images that weren't taken with flash), and can be NEF or JPEG.

1. Press the **MENU** key to show the menu system.

2. Use the Direction pad to navigate to the RETOUCH menu (paintbrush icon tab) and press the ▸ key on the Direction pad or the **OK** button to enter the menu.

3. Use the Direction pad to navigate to **Red-eye correction** and press the ▸ key on the Direction pad or the **OK** button to select it.

4. You'll be presented with thumbnails of six images at a time.



   a. Use the Direction pad ◂ and ▸ keys (or Rear Command dial) to navigate to the image you wish to work with.

   b. Use the Zoom In button (🔍) to see the currently selected image in full screen size.

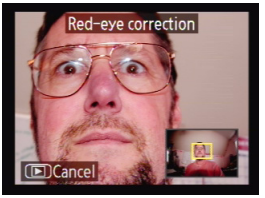
   c. Press the **OK** button to select the image you wish to change.

5. The camera looks at the image and tries to detect red-eye. If it does not, it will report **No red-eye detected** and you'll be returned to Step 4.

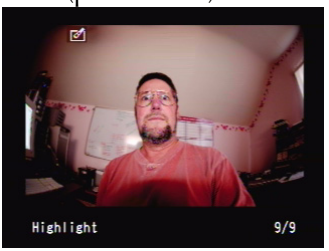
   Otherwise, the camera will display an hourglass icon for a moment to indicate that it is creating a modified image according to your instructions. After a few moments, you'll see the new image and be offered to

review and/or save it.

Review:

Zoomed: 

The modified version of your image will appear with a special icon (paintbrush):



Note: If you zoomed this page way up you might have noticed that there's still a bit of red-eye in this photo, even after the correction. I intentionally tried to create a photo that produced a worst-case red-eye situation. I seem to have succeeded.

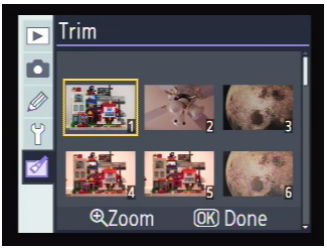
Trim

Sometimes you'll take a picture that covers more area than you want in the final image (for example, you couldn't get closer to your subject or didn't have a long enough telephoto lens). Eventually, you'll want to crop that image to get rid of the extraneous parts. The D80 allows you to do that in camera (though with some size constraints that might not match what you want to do).

To use **Trim**, you must first take a picture. That picture can be NEF or JPEG, black and white or color.

1. Press the **MENU** key to show the menu system.
2. Use the Direction pad to navigate to the RETOUCH menu (paintbrush icon tab) and press the ▸ key on the Direction pad or the **OK** button to enter the menu.
3. Use the Direction pad to navigate to **Trim** press the ▸ key on the Direction pad or the **OK** button to select it.

4. You'll be presented with thumbnails of six images at a time.



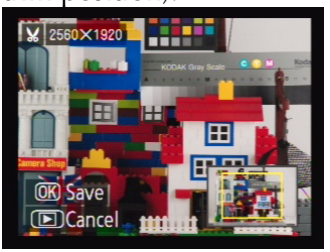
   a. Use the Direction pad ◂ and ▸ keys (or Rear Command dial) to navigate to the image you wish to work with.

   b. Use the Zoom In button (🔍) to see the currently selected image in full screen size.

   c. Press the **OK** button to select the image you wish to change.

5. The camera now shows two examples of the image. The full screen is the "cropped" version, while a smaller inset in the lower right appears only briefly and shows you how your crop is made from the larger, original image (the yellow outline shows the current

trim position).



a. Use the Zoom In (🔍) and Zoom Out (🔍▦) keys to change the amount of trim you wish applied. For a full-sized image you have the options of: **2560x1920**, **1920x1440**, **1280x960**, **960x720**, and **640x480**.

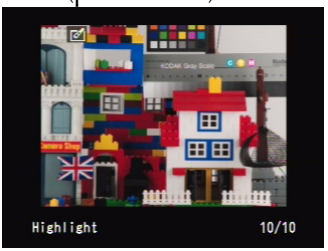
b. Use the Direction pad keys to move the area being trimmed.

c. Press the ▶ button to cancel the process and *not* create a modified image.

d. Press the **OK** button to complete the trimming process.

6. After pressing the **OK** button in Step 5, the camera will display an hourglass icon for a moment to indicate that it is creating a modified image according to your instructions. After a few moments, you'll see an **Image Saved** message and be returned to normal image review.

The modified version of your image will appear with a special icon (paintbrush):



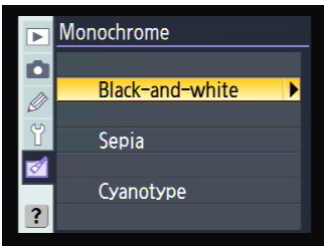
Monochrome

While the D80 has the ability to shoot black and white images directly (see "Custom: Black and White" on page <292>), you can also create them after the fact using this function.

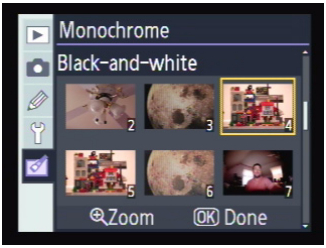
To use **Monochrome**, you must first take a picture. That picture needs to be color (i.e., you can't apply this to black and white images shot or created after the fact with the D80), and can be NEF or JPEG.

1. Press the **MENU** key to show the menu system.
2. Use the Direction pad to navigate to the RETOUCH menu (paintbrush icon tab) and press the ▸ key on the Direction pad or the **OK** button to enter the menu.
3. Use the Direction pad to navigate to **Monochrome** and press the ▸ key on the Direction pad or the **OK** button to select it.

4. Use the Direction pad to navigate to one of the three types of black and white images that can be created and press the ▸ key on the Direction pad or the **OK** button to select it.



5. You'll be presented with thumbnails of six images at a time.

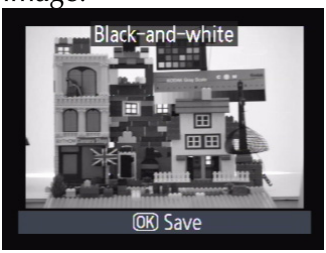


   a. Use the Direction pad ◀ and ▶ keys (or Rear Command dial) to navigate to the image you wish to work with.

   b. Use the Zoom In button (🔍) to see the currently selected image in full screen size.

   c. Press the **OK** button to select the image you wish to change.

6. The camera now shows an example of the converted image.



   a. For **Sepia** and **Cyanotype** use the ▲ and ▼ keys on the Direction pad (or Rear Command dial) to change the level of the effect you wish applied. The amount of "color" applied to the monochrome image is increased or decreased accordingly.

   b. Press the ▶ button to cancel the process and *not* create a modified image.

   c. Press the **OK** button to begin the change process.

7. After pressing the **OK** button in Step 6, the camera will display an hourglass icon for a moment to indicate that it is creating a modified image according to your instructions. After a few moments, you'll see an **Image Saved** message and be returned to normal image review.

The modified version of your image will appear with a special icon (paintbrush):

Filter Effects

A very interesting retouching tool is the Filter Effects option. This allows you to change the color balances in the image using one of three techniques:

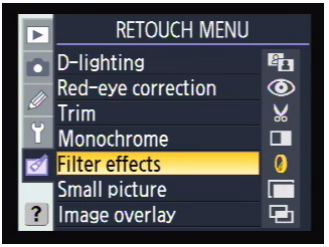
- **Skylight filter**—this option places a slight "cool" color cast on the image, with an emphasis on the *slight*.
- **Warm filter**—this option places a slight "warm" color cast on the image, again with an emphasis on the *slight*.
- **Color balance**—the most interesting of the options, as it allows you to use the CIE two-dimensional color space to change the colors in your image. The range of change is much higher here and fully under your control. For that reason I'd use this option over the other two if you're serious about changing color in your image using the camera.

To use **Filter effects**, you must first take a picture. That picture needs to be color (i.e., you can't apply this to black and white images shot with the D80), and can be NEF or JPEG.

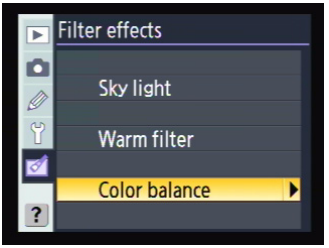
1. Press the **MENU** key to show the menu system.

2. Use the Direction pad to navigate to the RETOUCH menu (paintbrush icon tab) and press the ▸ key on the Direction pad or the **OK** button to enter the menu.

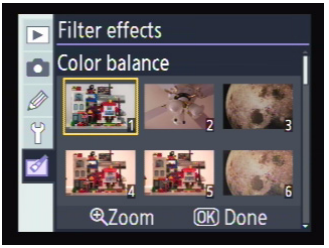
3. Use the Direction pad to navigate to **Filter effects** and press the ▸ key on the Direction pad or the **OK** button to select it.



4. Use the Direction pad to navigate to one of the three filter options and press the ▸ key on the Direction pad or the **OK** button to select it.



5. You'll be presented with thumbnails of six images at a time.



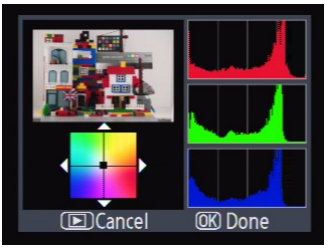
   a. Use the Direction pad ◂ and ▸ keys (or Rear Command dial) to navigate to the image you wish to work with.

   b. Use the Zoom In button (🔍) to see the currently selected image in full screen size.

c. Press the **OK** button to select the image you wish to change.

6. The camera now shows an example of the image, as modified. For **Skylight filter** and **Warm filter** your only choices are to cancel or save the change (Steps 6c and 6d, below).

Color balance:



Filters:

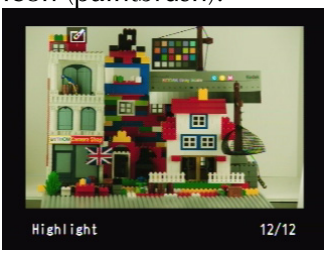
a. For **Color balance** use the keys on the Direction pad to move the color space position (box in lower left of the display; the black square is your current position within the space). Note that this CIE color box is trying to show you what the primary color *added* to the image will be, while the histograms on the right side of the display help you keep from increasing a value so much that it blows out a channel (very possible using this control—try moving the black dot representing your position in the CIE space to one of the extreme corners of the box).

b. Press the ▶ button to cancel the process and *not* create a modified image.

c. Press the **OK** button to select the image you wish to change.

7. After pressing the **OK** button in Step 5, the camera will display an hourglass icon for a moment to indicate that it is creating a modified image according to your instructions. After a few moments, you'll see an **Image Saved** message and be returned to normal image review.

The modified version of your image will appear with a special icon (paintbrush):



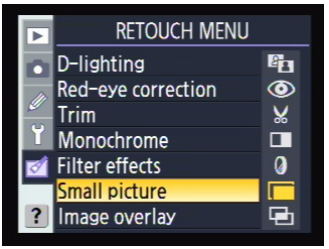
Small Picture

At first, you may think that this option is like **Trim**. It isn't. The difference is that **Trim** *crops* and image while **Small picture** just creates a smaller version of the *full* image.

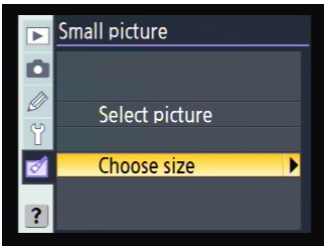
To use **Small picture**, you must first take a picture. That picture can be NEF or JPEG, black and white or color.

1. Press the **MENU** key to show the menu system.
2. Use the Direction pad to navigate to the RETOUCH menu (paintbrush icon tab) and press the ▸ key on the Direction pad or the **OK** button to enter the menu.
3. Use the Direction pad to navigate to **Small picture** press the ▸ key on the Direction pad or the **OK** button

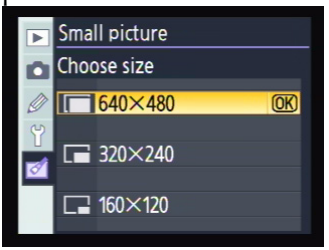
to select it.



4. Use the Direction pad to navigate to **Choose size** and press the ▸ key on the Direction pad or the **OK** button to select it.

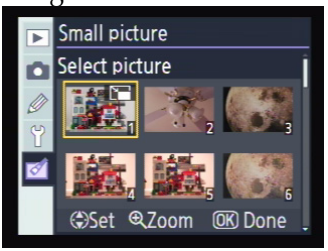


5. Use the Direction pad to choose the size image you wish to create and press the ▸ key on the Direction pad or the **OK** button to select it.



6. Use the Direction pad to navigate to **Select picture** and press the ▸ key on the Direction pad or the **OK** button to select it. *Note:* despite the name, you actually get to select *pictures*, not a single picture!

a. You'll be presented with thumbnails of six images at a time.



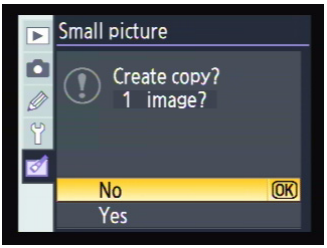
i. Use the Direction pad ◀ and ▶ keys (or Rear Command dial) to navigate to an image you wish to create a smaller version of.

ii. Use the Zoom In button (🔍) to see the currently selected image in full screen size.

iii. Use the ▲ and ▼ keys on the Direction pad to select or deselect images you wish to create smaller versions of. A "smaller picture" icon is placed on each image you select (see image 1 in the example).

iv. Press the **OK** button to complete selection of the images you wish to change.

7. The camera now shows the following display:



a. Use the Direction pad to navigate to **Yes**.

b. Press the **OK** button to complete the new image creation process.

8. After pressing the **OK** button in Step 5, the camera will display an hourglass icon for a moment to indicate that it is creating a modified image according to your instructions. After a few moments, you'll see an **Image Saved** message and be returned to normal image review.

The modified version of your image will appear with a special paintbrush icon. All images created with this option also appear with a gray border around them on the color LCD to indicate that they're a smaller size than the picture took.

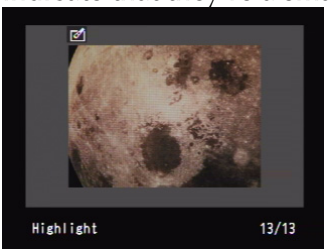


Image Overlays

The D80 has an in-camera facility for creating composite images. Things to note about this function:

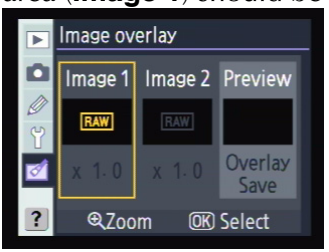
	Image Overlay Function
Number of shots	2 only
Image Format	Pre-shot NEFs are used to create a finished JPEG or NEF
Auto Gain	No, though you can preview the final effect of the overlay
Image Quality settings	Are applied from first image to the final "overlaid" image
EXIF Data	Is applied from first image to the final "overlaid" image

Here's how to use image overlays:

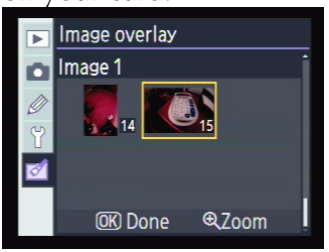
1. Shoot two images you'd like to combine. Make sure that these are in NEF format.
2. Press the **MENU** key to show the menu system.

3. Use the Direction pad to navigate to the RETOUCH menu (paintbrush icon tab) and press the ▸ key on the Direction pad to enter the menu.
4. Use the Direction pad to navigate to **Image overlay** and press the ▸ key on the Direction pad to select it.

5. You'll see an overlay preview screen. The first image area (**Image 1**) should be highlighted:

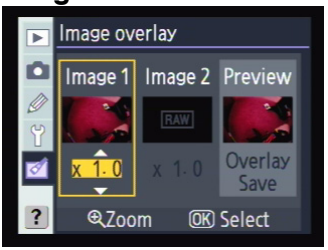


   a. Press the **OK** button to show the NEF images on your card.



   b. Navigate to the image you want to use as your base image.

c. Press the **OK** button to use that image as **Image 1**.

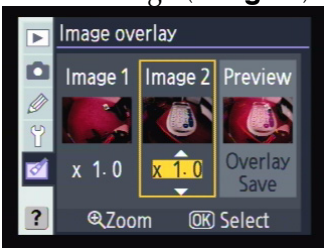


d. Use the ▼ and ▲ keys on the Direction pad (or Rear Command dial) to adjust the "gain" for **Image 1**. A value of 1.0 means use the exposure as is. A value of 0.5 would mean to use half the normal exposure, a value of 2.0 uses twice the exposure. You can set values between 0.1 and 2.0 for each image.

e. Press the ▶ key on the Direction pad to select the second image area (Image 2).

f. Once again press the **OK** button to show the NEF images on your card.

g. Navigate to the image you want to use as your second image (**Image 2**).

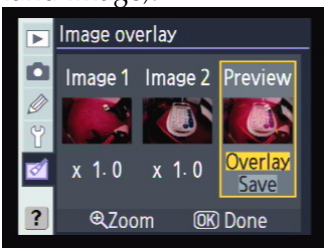


h. Press the **OK** button to use that image as **Image 2**.

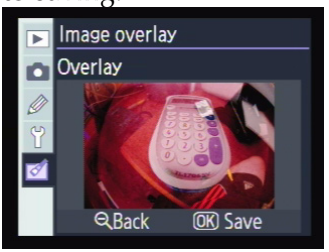
i. Use the ▼ and ▲ keys on the Direction pad (or Rear Command dial) to adjust the "gain" for **Image 2**.

6. You may use the Direction pad to navigate back and forth between the two images to adjust the gain for the two images. At any time you can press the Zoom In button (🔍) to get a full screen version of the currently selected image.

7. When you're satisfied with the images selected and the gains assigned them, use the ▶ key on the Direction pad to navigate to the Preview image (right-hand image):



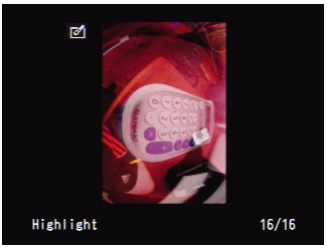
a. Navigate to **Overlay** and press the **OK** button to see a full screen preview of the effect prior to saving.



b. Or navigate to **Save** and press the **OK** button to complete the effect.

8. It'll take a few seconds to combine the images, and during that time an hourglass appears over the screen to indicate that the camera is working at combining the images. When complete, it'll be as if you shot an

image with the camera (e.g. if you have Image review **On**, you'll see the image on the color LCD as if it had just been taken by the camera; image data for the EXIF fields is taken from the first image).



Note: *If you try to combine a vertical and horizontal image, the camera will ignore the difference in rotation when combining the two images. However, as you can see from the above example, the camera* will *pick up the rotation of the first image and use that for the final image (that's because rotation is in the EXIF data!).*

The question you're probably asking yourself is this: is there a reason to use the overlay function? Maybe. It seems to me that the strongest use of this function would be for the classic moon + landscape sandwich. This allows you to use a wider lens for the landscape and a more telephoto lens for the moon (to make it a bigger object in the sky). This would work best if the sky were truly black so that you aren't adding sky exposure into the moon (and the moon's sky exposure into the landscape).

Another possibility is to shoot a person against a black background and have them talk to themselves (e.g. one pose on one side of the image and a second one on the other side). Instant twins!

But the function is interesting enough to provoke play on my part. Usually you'll want detail in one picture where there is only a plain area in the other (and vice versa), but that's not universally true, so experiment. One thing this function is great for is creating Halloween ghost pictures. Try it next Halloween when you take pictures of your kids in costume!

(What makes me think some wedding photographer is going to pull all of the above on some unsuspecting bride? ☺)[144]

Transferring Your Images to Your Computer

Images are stored in your D80 on a Secure Digital card. You can get those images off the card into your computer in three basic ways:

1. Connect the camera to a computer via cable.
2. Remove the card from the camera and put it into a card reader slot or attached device to your computer.
3. Remove the card from the camera, put it into a portable storage device such as the Coolwalker or Epson P-2000 and transfer the images. Later, connect the portable storage device to your computer and transfer the images from it to one of your hard drives.

Methods #1 and #2 are the most commonly used transfer mechanisms. I usually recommend #2 over #1. First, if you're shooting a lot of images, you probably have multiple cards you want to transfer. Second, I worry a bit more about wearing out or damaging the rubber gasket and USB connector on the D80 than I do the card slot. Batteries also get consumed quickly when you use the camera for direct transfers, and batteries have a finite number of recharges they'll sustain. Finally, I think that the less you have to handle the camera, the longer that it'll last (think of having your camera sitting on your desk connected to the computer—will *you* spill drinks on it or accidentally knock it off onto the floor?).

Method #3 is the one that I normally use. It's my preferred method because I'm away from the office for long stretches of time, so the portable storage device acts as a temporary home

[144]Okay, they will, guaranteed. At one of my workshops in the ghost town of Bodie, we ran into a wedding there (turns out you can rent the church for such occasions for US$500, in case you're interested). I won't describe all the crazy shots the photographer was taking, but let's just say that she was way *beyond* creative.

for my images (I regularly back up the portable storage device to another USB drive connected to my laptop, by the way). This frees up my cards for more use and puts all of my images from a trip in one place, which makes it easier to transfer them all when I get home.

Still, you'll want a card slot or card reader on your computer just in case you ever need to resurrect accidentally "deleted" images or if you need to reformat the card for some reason.

Both of the first two methods require either specialized software or manual copying. (The third method requires special hardware, as well.)

If you plug the camera into your computer, the Secure Digital card in the D80 will show up as a "drive" on your computer (on Windows that's true whether you've set the **USB** function to **Mass Storage** or **PTP** [145]). Thus, you can manually drag files from the camera to your computer, just as you would move files from any drive to another.

Automated copying works better, in my opinion, because it gives you renaming options, if nothing else. Photoshop Elements, Apple iPhoto, Nikon PictureProject, Nikon View, and a host of other programs install automated copying processes that pop up when you connect your camera or insert your camera's card into a slot or reader on your computer. I'll deal with PictureProject in detail later in this eBook. For most other programs, you'll need to consult their documentation.

[145] It is different for Macintosh users: the camera doesn't show up as a drive unless you've selected **Mass Storage**, which explains Nikon's default to **Mass Storage**.

Connecting to a Computer

The USB connector is the small, shiny connector situated at the top (left picture) on the left side of the camera under the rubber door. In the right picture I've plugged the supplied USB cable into the D80.

The D80 includes a USB (2.0 compatible) interface for connecting the camera to computers. This connection type is available on most computers made in the past few years. Your computer must have the appropriate interface available and be configured correctly (users of older versions of Windows need to be sure that the proper drivers are installed and active [which is typically done when you install PictureProject]; all recent Macs will automatically recognize the D80 and start iPhoto, even though you haven't installed any specific D80 software!).

The D80 comes with a UC-E4 USB cable, though it's relatively short. If you choose to replace Nikon's cable with one from a third party, note that ~15 feet (5m) is the maximum distance at which the D80 can reliably communicate with the computer through USB [146].

We've got one other issue to deal with: how the D80 presents itself on the USB port. Essentially, there are two options:

- *Mass Storage device*. In this mode, the D80 gets out of the way and acts basically like a (very expensive) card reader. When the camera is successfully attached to the computer, the computer treats the card in the camera as a removable disk drive. The only thing the computer can access is the data on that card. This is the default USB mode for the D80, and what you should use if your

[146]Nikon warns that the use of a hub makes it so that high-speed USB transfers don't work. Put another way, Nikon disclaims support beyond the usual 15 feet (5m) when the camera is directly connected to a computer USB port.

computer is running an older version of Windows (98, Me, 2000) or Macintosh OS (9.x).

- *Point to point device*. In this mode, the D80 talks to the computer directly and the computer can direct what the camera does. Essentially, the USB cable is like a network cable between two intelligent devices. This is the mode you need to be in if you want to control the camera from the computer using Nikon Camera Control Pro with Windows XP or Macintosh OS-X [147].

To set the USB connection mode:

1. Press the **MENU** button to show the menus on the color LCD.
2. Use the Direction pad to navigate to the SET UP menu (wrench icon) and press the ▸ key or the **OK** button to select it.
3. Use the Direction pad to navigate to the **USB** option and the ▸ key or the **OK** button to select it.

4. Use the Direction pad to navigate to **PTP** and press the ▸ key or the **OK** button to select it.

[147] You can use **Mass Storage** for Windows XP or Macintosh OS-X, but you'll lose the ability to control the camera from Capture. There's no penalty for setting **PTP** on the newer OS versions, thus I recommend that you use **PTP** for them.

Connect your D80 to the PC as follows (assumes the computer is already configured and ON [148], and Nikon PictureProject has been installed):

1. Turn the camera OFF.
2. Plug one end of the USB cable into the connector on the lower left of the camera (it's under the bottom rubber door). The other end plugs into the appropriate connector on your computer. (You can't get the connections backwards; only one end fits the camera, only one end fits your computer.)
3. Turn the camera ON.
4. The computer should recognize the camera and start up a transfer operation if you have everything connected correctly. I deal with the remaining steps in the section on Nikon PictureProject later in this eBook (see "Nikon PictureProject" on page <605>).

Note: *If you've got a Macintosh, iPhoto may recognize the* DCIM *folder on the camera and attempt to start up, as well. To fix this in OS-X, make sure no cameras or card readers with* DCIM *folders on them are connected to the Macintosh. Open* Image Capture *(in the* Applications *folder). Choose* **Preferences** *from the* **Image Capture** *menu, then choose* **No application** *in the pop-up.*

[148] If the D80 is connected to the computer and turned ON when you boot (or reboot) your PC running Windows XP or Windows 2000, the computer may see the camera as a mass storage device and perform an integrity check of the "drive" (card in the camera). This is problematic for two reasons. First, **do not** cancel any such disk scan (usually accompanied by information about scan progress on a blue screen prior to the Windows main screen appearing) and **do not** reboot. If you interrupt the disk scan, it appears that the formatting of the card can be corrupted. But note that depending upon how large the card in the camera is, you may be waiting a considerable amount of time for the disk scan to complete (measured in minutes). Note that this may be true for some earlier versions of Windows as well—especially if you have "disk health" utilities installed—but I haven't been able to verify it as I no longer have any systems running older versions of Windows. Is there a way around this problem? Yes, don't have your camera connected to the computer when you boot!

5. When you're done with the connection, turn the camera OFF before removing the cable. But make sure that all transfers have completed before turning the camera OFF otherwise data may be lost.

Nikon designed the D80 so that it would continue to operate normally while connected to a computer. That means that you can take pictures while the camera is connected to the computer. You can also control the camera from the computer with Nikon Camera Control Pro, something that is useful in studio situations (see "Nikon Camera Control Pro" on page <662>).

Printing Your Images

You have three primary ways to print images you take with your D80:

1. Remove the Secure Digital card from the camera and take it somewhere that makes prints (in the US: Walmart, Costco, most camera stores, most drugstores; I'll call those "labs").
2. Connect the camera to a PictBridge-enabled printer and print directly. See "PictBridge Printing" on page <582>.
3. Transfer your images to your computer and print using the printer connected to your computer.

I've listed these basically in increasing order of cost per print and inconvenience. Having someone else make your prints is convenient and many places charge much less per print than you can achieve with an inkjet printer connected to your computer. PictBridge printing, especially with the small 4x6 printers that are becoming ubiquitous, is a little more expensive, but still very convenient. Transferring images to your computer and printing from there is usually the most time consuming and often the most costly per print.

If printing your photos is your primary goal, we have a few things we need to get out of the way:

- *Make sure the image is ready to print*. Most labs and all PictBridge printers require your image to be in JPEG format and using the sRGB Color Space (**Color Mode I** or **III** on the D80). You'll note that my recommendations for most folk ("Which Type of Photographer are You?" on page <515>) were to shoot JPEG and use the sRGB Color Space, so there's no real need to change anything if you're following those guidelines. However, if you shoot NEF files or use the AdobeRGB Color Space (**Color Mode II** on the D80) *you must transfer your images to a computer and process them correctly before sending the image out to print*.
- *Select the images to print*. The D80 has a feature—Print Set—that allows you to automate this process in the camera. If you take your images to a lab to be printed, you'll want to look into using this. See "Selecting Images to Print" on page <580>.
- *Get the images to the printer*. In the case of using a lab the simplest method is to simply take the Secure Digital card out of the camera and give it to the clerk at the lab. (But make sure you've used JPEG, sRGB, and have selected images to print first!) With PictBridge, it's as simple as plugging the camera into the printer and following the instructions in "PictBridge Printing" on page <582>. If you're going the computer-to-printer route, the combinations and permutations of things you might want or need to do is more complex and involved than I can present quickly in this eBook. Basically, you transfer the images to your computer, edit them using software on your computer (e.g. Photoshop Elements), then use that software to send the images to your printer. Just be warned that there are all kinds of variables you'll need to be aware of, from using the right printer profiles for the paper and ink you're using to getting the resolution aligned correctly (see "Printing Resolution" on page <587>).

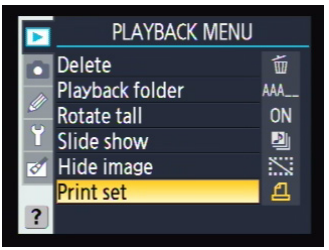
Selecting Images to Print

The D80 supports the DPOF specification (Digital Print Order Format), which allows you to insert your Secure Digital card into a DPOF enabled printer and automatically get prints of images pre-marked for printing (called the "print set"). Most inkjet printers that allow you to insert a Secure Digital card support DPOF (e.g., the Epson 875), as do most print labs that accept Secure Digital cards for printing.

Pre-selecting your images for printing before you get home to your printer or before take your card into a lab can save you time, as it means that you don't have to scroll through them individually after the fact. In other words, you could add to your print set as you shoot in the field, then be ready just to print your chosen images immediately when you get home or to the lab.

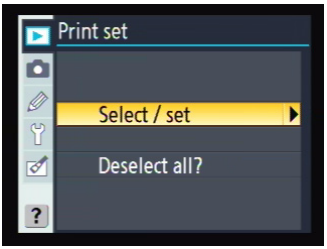
- To pre-select images to be printed:

1. Press the **MENU** button to show the menus on the color LCD.
2. Use the Direction pad to navigate to the PLAYBACK menu.
3. Use the Direction pad to navigate to **Print set** and press the ▸ key on the Direction pad or the **OK** button to select it.

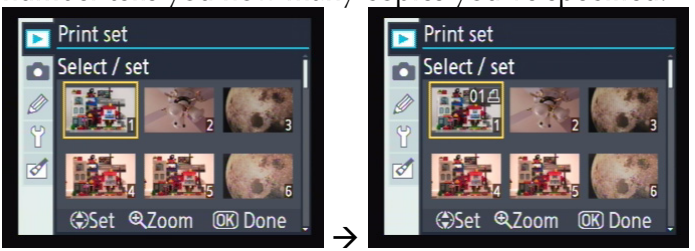


4. Use the Direction pad to navigate to **Select / Set** and press the ▸ key on the Direction pad or the **OK** button

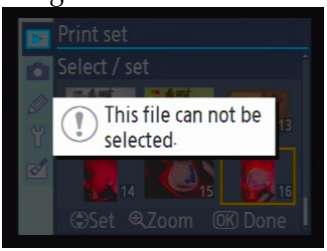
to select it.



5. The camera displays a thumbnail view of the images, six at a time. Navigate through them exactly as you would in thumbnail view (◀ and ▶ key or Rear Command dial), pressing the ▲ key on the direction pad to increase the number of copies you want to print of an image or the ▼ key on the direction pad to decrease the number of copies. A small 1🖶 icon indicates that the image will be printed and the number tells you how many copies you've specified.



NEF files cannot be chosen for the print set; you'll see the message **This file can not be selected** when you press the keys on the Direction pad to select NEF images.



6. You confirm the print set by pressing the **OK** button.

Note: DPOF printers expect images using the sRGB color space. If you plan to use the **Print set** *option, you should set the*

Color Space of your D80 to **Color Mode I** or **III**. *See "Color Profiles, Color Spaces, and Color Modes" on page <522>.*

So what have you done here? Essentially you've put data into the EXIF fields for the image that most digital camera aware printers will pick up on (e.g. printers that have the DPOF logo). When a group of such images is presented to the printer—usually by putting your Secure Digital card into a slot on the printer—the printer sees the fields (print, number of copies, imprint data request) and uses them to automatically create your prints, as requested.

PictBridge Printing

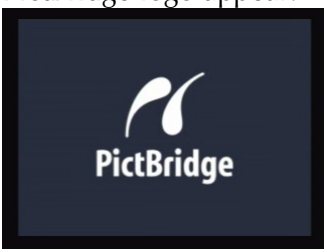
The steps for printing using PictBridge to print are also simple (I'll use a Sony DPP-FP30 in my example, but any PictBridge printer should work similarly):

1. Press the **MENU** button to show the menus on the color LCD.
2. Use the Direction pad to navigate to the SET UP menu.
3. Use the Direction pad to navigate to **USB** and press the ▸ key on the Direction pad or the **OK** button to select it.

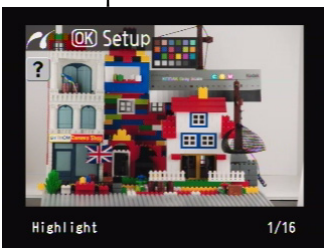
4. Use the Direction pad to navigate to **PTP** and press the ▸ key on the Direction pad or the **OK** button to

select it.

5. Ready the printer (insert media and cartridges and turn the printer ON).
6. First connect the UC-E4 USB cable that came with the camera to the printer's PictBridge port.
7. Next connect the UC-E4 cable to the camera's USB port. After a few seconds you should see the PictBridge logo appear:

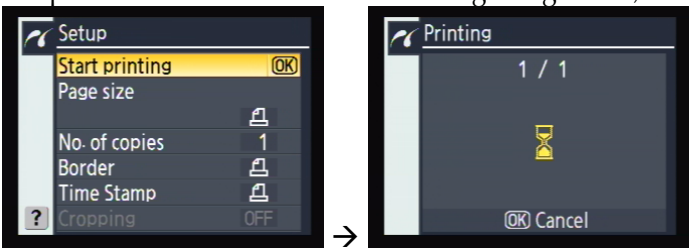


This takes you directly to a "browsing mode," where you can directly print pictures. You'll be shown the current image on your card with a PictBridge overlay at the top:

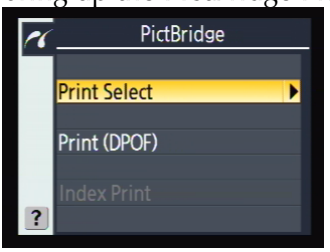


8. You may simply scroll through the images pressing the **OK** button on each image you want a print of; you'll be prompted to **Start Printing**. Press the ▸ key and then you'll see something like the following screen while your print is made (the card access light on the

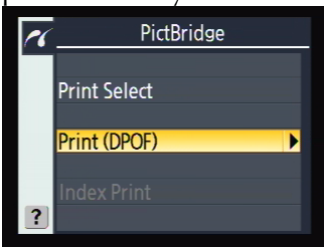
back of the D80 illuminates—usually blinks—while the printer and camera are transferring image data):



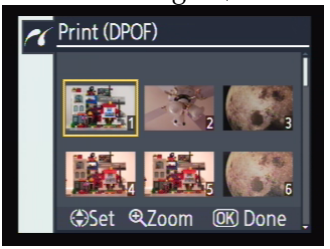
or you can press the **MENU** button on the camera to bring up the PictBridge Print Menu:



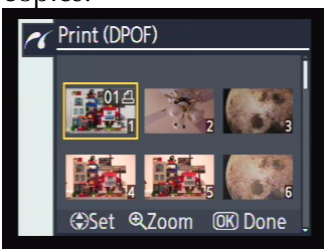
9. If you've identified photos to print using DPOF, use the Direction pad to navigate to **Print (DPOF)** and press the ▸ key on the Direction pad to select it.



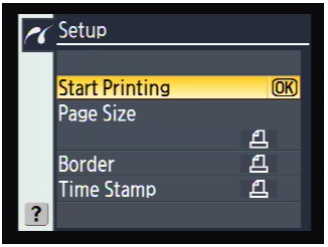
   a. You're taken to a page that displays your available images (no raw files will show).



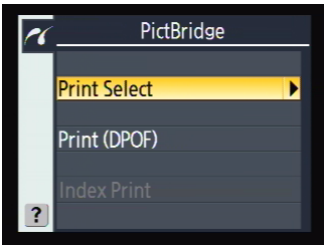
b. If you want to add images to the print set, you navigate to each image you wish to print and press the ▲ and ▼ keys on the Direction pad to increment or decrement the number of copies.



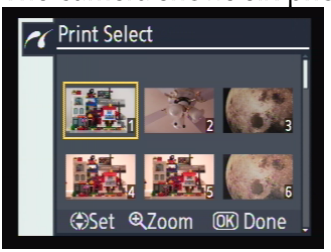
c. When you're ready to print, press the **OK** button, navigate to **Start printing**, and press the ▸ key on the Direction pad or the **OK** button.



10. Assuming that you didn't use DPOF, you can alternatively navigate to **Print select** from the main PictBridge menu and press the ▸ key or the **OK** button to select it.



a. The camera shows six photos at a time.



b. Use the Direction pad to navigate to the photo(s) you wish to print and then

1. Press the ▲ and ▼ keys on the Direction pad to increment or decrement the number of copies you want.
2. When you've selected all the images you wish to print, press the **OK** button
3. You're taken to the Setup screen, where you may be able to choose options for print size, border, and time stamp (depends upon your printer [149]).
4. Press the ▶ key on the Direction pad or the **OK** button to start printing.

11. When you're done printing, turn the camera Off, then unplug the cable.

Note: DPOF and PictBridge printers expect images using the sRGB color space. If you plan to use either to print, you should set the Color Space of your D80 to **Color Mode I** or **III**. *See*

[149] I originally thought to show each of these options, but found with just a few PictBridge printers the combinations and permutations were piling up in a way that would have added many pages to this work. Fortunately, the D80 will only show you the options that are available for the printer you're connected to (all others will either not appear or be disabled), so it should be relatively obvious what you can and can't do by what appears in this menu.

"Color Profiles, Color Spaces, and Color Modes" on page <522>.

Note: The D80 stays powered and active the entire time that it is connected to a PictBridge printer. Batteries can get exhausted rapidly: in printing a dozen images, for example, the battery in my D80 lost about half its charge. Generally, I'd recommend that you use the EH-5 AC Adapter to power the camera when printing directly from the camera.

Printing Resolution

Okay, if you're reading this section you've opted to print images from your computer to your printer instead of using a direct PictBridge connection to the camera. While this might seem easy enough, you're left on your own devices by most camera and printer companies (and even most software companies). The one area that usually stops first timers dead is resolution.

Resolution is a word that's often used casually in the digital world. The camera has 3872 x 2592 pixels of resolution. Your printer might claim 1440 dpi (dots per inch) resolution. Your computer monitor might have 1280 x 1024 pixels of resolution. Or it might be specified as 90 dpi. Photoshop might report your JPEG images as having 72 dpi. Are you confused yet?

Don't be. Most of the numbers you encounter in the resolution world are arbitrary. Let's make them work for us. Your D80 can capture 3872 pieces of information across the (usually) horizontal axis. That's an *absolute*. There really are 3872 pieces of data to deal with in that axis (assumes **Image size** is set to **Large**). What happens as that image moves to other devices is where things get murky for some.

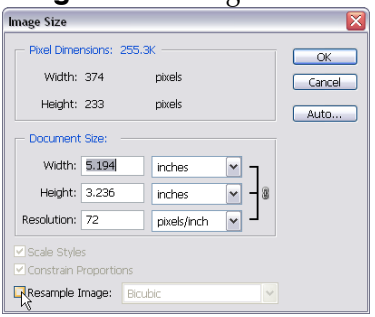
On your computer monitor, for example, you might specify to view your 3872 x 2592 pixel image via your software's **Fit in Window** command. If the maximum size of that window is 640 x 480, obviously the software has to *scale* the original data in some way. Normally, it does this by creating a temporary, interpolated *copy* of your data. Nothing changed

in your original data. But you're also no longer looking at your original data! That's why you'll find that most tutorials on post processing ask you to look at the effects of destructive tools like **Sharpening** filters at **100% View**. That way you see the exact effect on (a portion of) your original data, not a simulation of it. *Bottom line:* viewing at different scales or sizes on your computer monitor does not change the actual "resolution" of your image.

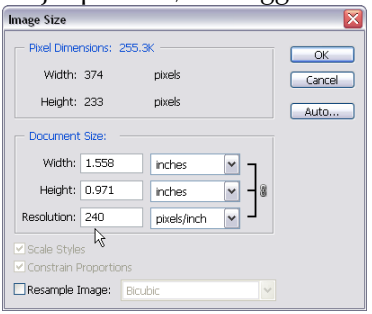
Another place where we see resolution numbers is in the software we use. For example, if you use Photoshop or Photoshop Elements **Image Size** command, you'll see a entry called **Resolution** that's specified in **pixels/inch** (or **pixels/cm**). For D80 JPEG images this value will normally be **72**. This is an *arbitrary* assignment by the software program and sometimes controlled by a value in the EXIF data. Above this value you'll often see values for the width and height for the image if it is printed *at that dpi*. Read it this way: *IF you print at that pixels/inch value your photo will be X" high and Y" wide*. That's a big IF. Usually we want to print at a specific pixels/inch value that will maximize the output of our printer.

The D80 places a 72 dpi marker in JPEG files and a 300 dpi marker in NEF files (actually, it's usually the software converter that sets that). If we have to change the dpi value (but *not* change the original pixels), we do this by:

1. Unchecking the **Resample Image** box in Photoshop's **Image Size** dialog.



2. Entering a new value in the **Resolution** box in the **Image Size** dialog. (For an Epson and most other inkjet printers, I'd suggest 288 pixels/inch.)



If you then need to *resize* the image, set your dpi value as just described, then

3. *Recheck* the **Resample Image** box.

4. Enter new dimensions in the **Width** and/or **Height** boxes. However, if you perform this step, you'll no longer be dealing with the actual pixels you captured while shooting, but Photoshop's interpolation of them at the new size.

Why do we specify the "resolution" as 288 dpi for printing? Because typically that's the most pixels per inch you need to send to an inkjet printer to get a very high perceived quality. Anything over that makes changes that are very difficult to see, if they can be seen at all. The printer driver of your printer "invents" in-between pixels, if necessary, to maximize its output quality, but those invented pixels are usually good enough that we don't have to supply them in the first place.

Note: If you've been following that discussion and set your D80 images to 288 dpi for printing on your inkjet printer that means that a D80 image will print as a 9 x 13.5" image after Steps 1 and 2 are completed. To create a printed image larger than that, you'd need to do Steps 3 and 4, above.

Output on Commercial Printers

While it's a little bit out of the scope of this book, enough D80 users have asked me about professional printing options that it makes sense to give a brief set of tips here, especially since color issues are usually the biggest complaint.

As I write this, the Fuji Frontier is probably the most ubiquitous automated printer you'll run into at labs (and Wal-Mart and Costco in the US) [150]. Thus, I'll present the overall workflow for it (other printers should be similar—but work with your lab to verify each step I present). The following example assumes you use Photoshop or Photoshop Elements (other software products should be similar, but may use different file extensions or command names):

1. Crop, size, adjust, and sharpen your image as usual.
2. Instead of 288 dpi (see "Printing Resolution" on page <587>), use 300 dpi.
3. If you're working in Photoshop, save your edited copy as a .PSD file in case you need to revisit your changes. (If you're working in another editor, save in its native file format.)
4. Flatten all layers, if any.
5. If the image isn't already in 8-bit RGB mode, convert the image to 8-bit RGB color (16-bit RGB color and Lab Color aren't usually supported by commercial printers). In Photoshop, this is done on the **Image** menu on the **Mode** sub-menu.
6. Use the **Canvas Size** menu item to make sure that your final image size is one that the Frontier supports (e.g., 8x10" in the US). In other words, if the final crop of your image was 7x9.5" you would use **Canvas Size** to center that on an 8x10" canvas. (If you don't perform this step, the Frontier—and most other

[150]The popular Noritsu and a few other commercial printers are similar. Try following the directions given here for them—you'll probably find that it works for them, too.

automated printers—resizes your image, causing all kinds of ugly artifacts.)

7. Use Photoshop to *convert* the Color Space you were working in, if necessary (e.g. AdobeRGB), to the one the Frontier uses (sRGB). (If you give a Frontier an image in a Color Space it doesn't support, guess what, you get wrong colors!)
8. Save the image as a TIFF or JPEG file. *Do not* embed the Color Space (usually a checkbox in the **Save** dialog; it's ignored by the printer, anyway).
9. Save all your images on a CD-R and take them to the printer.

Viewing Your Images

The D80 can be connected to a television so that what would normally appear on its color LCD appears instead on the TV. It can also present a "slide show" of all the images on the Secure Digital card inside your camera.

Television Playback

The video connection (bottom connector under top rubber door, and labeled **Video Out** *on the door) is on the left side of the camera (and interferes with holding the camera when connected to a television). Nikon supplies a short video cable with the camera. I've plugged my cable into the connector here.*

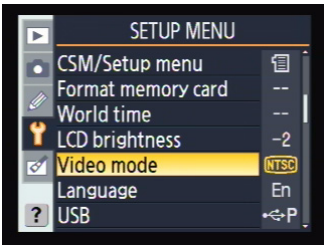
Before connecting the D80 to a television, you must tell the camera what kind of video standard to use:

NTSC The video standard in the US, Canada, and Japan.

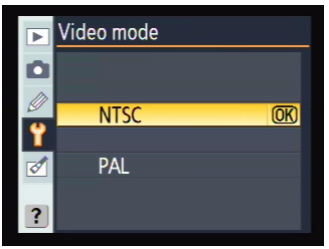
PAL The standard in the UK and many European countries.

📷 To set the camera's video standard and connect it to a television:

1. Press the MENU button to display the menus.
2. Use the Direction pad to navigate to the SET UP menu (wrench icon) and then the ▸ key on the direction pad or the **OK** button to select it.
3. Use the Direction pad to navigate to **Video mode**, and then the ▸ key on the Direction pad or the **OK** button to select it.



4. Use the Direction pad to navigate to either **NTSC** or **PAL**, and then the ▸ key on the direction pad or the **OK** button to select it.



5. Turn the camera OFF.
6. Plug one end of the EG-D2 video cable into **Video Out** jack on the left side of the camera, the other ends into the **Video In** and **Audio In** jacks on your television. Your TV must be set to its **Aux** or similar composite video input setting.
7. Turn the camera ON. Operate the camera as you would normally while reviewing images.
8. When you're done, turn the camera OFF before unplugging the video cable.

You may also plug the D80 into a VCR's **Video In** and **Audio In** connections. Depending upon your VCR and television, to

see the image from the D80 you will either have to have the VCR feed the TV's **Aux** (composite video) input or tune the television attached to the VCR to a specific channel (usually 3 or 4) after pressing a button on the VCR (usually **Aux** or **Line**).

One thing that surprises some D80 users is that the camera still functions normally when connected to a television. Yes, that means that you can take pictures with the camera hooked up to a TV. Anything that would normally be displayed on the color LCD appears instead on the television. This facility is useful in studio shooting.

Note: You should note that battery consumption for the camera is considerably higher as long as it driving an external display device. The D80 continues to show images on a television for up to 10 minutes, after which this connection is turned OFF, regardless of the color LCD's status or the camera's timeout settings.

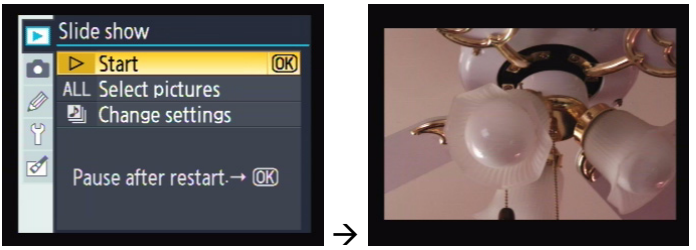
Note: If the camera is connected to a PAL compatible television (and **Video Output** *is set to* **PAL***), output resolution is reduced somewhat, as the camera has to alter the number of bits in the thumbnail to adapt the image to the screen resolution.*

Slide shows

The D80 has a slide show function built into it, allowing you to show one or more folders of D80 images in sequence, with a specific delay between each image (two to ten seconds). Unique to the D80 is the ability to add one of five preset music tracks to the slide show. Since the D80 can be connected to a television (see "Television Playback" on page <591>), this allows you to shoot images and them show them to a group of people as a completed presentation.

You make the camera display all the images in the current folder in sequence by selecting the **Slide show** option from the PLAYBACK menu. When you do so, you'll see an additional menu (below) that allows you to **Start** the show, select the pictures to be shown, or choose **Change settings**

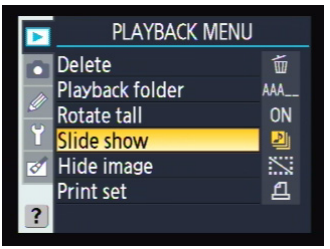
(style of slide show, and depending upon style, either time each image is displayed or background music).



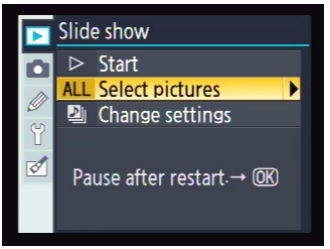
Note that the slide show is full frame (no text).

Your first step should be to choose the images you wish to be in the slide show:

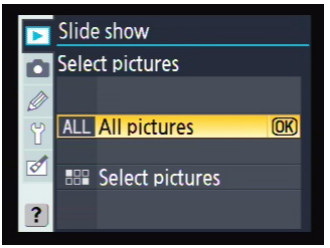
1. Press the **MENU** key to show the menu system.
2. Use the Direction pad to navigate to the PLAYBACK menu (play button icon) and press the ▸ key on the Direction pad or the **OK** button to enter the menu.
3. Use the Direction pad to navigate to **Slide show** press the ▸ key on the Direction pad or the **OK** button to select it.



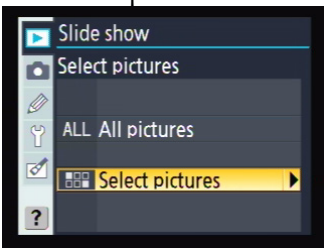
4. Use the Direction pad to navigate to **Select pictures** and press the ▸ key on the Direction pad or the **OK** button to select it.



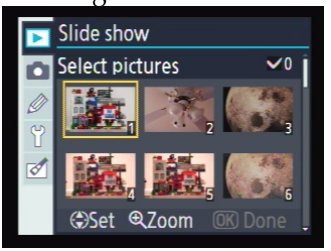
a. If you wish to use all the non-hidden pictures on the Secure Digital card in the camera, use the Direction pad to navigate to **All pictures** and press the ▸ key on the Direction pad or the **OK** button to select it.



b. Alternatively, if you wish to use only selected pictures, use the Direction pad to navigate to **Select pictures** and press the ▸ key on the Direction pad or the **OK** button to select it.



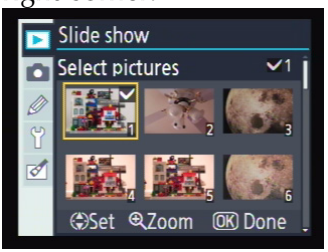
i. You'll be presented with thumbnails of six images at a time.



ii. Use the Direction pad ◂ and ▸ keys (or Rear Command dial) to navigate to an image you wish to create a smaller version of.

iii. Use the Zoom In button (🔍) to see the currently selected image in full screen size.

iv. Use the ▲ and ▼ keys on the Direction pad to select or deselect images you wish to see in the slide show. A ✔ icon is placed on each image you select (and a count of the number of images in the slide show is shown in the upper right corner.



v. Press the **OK** button to complete selection of the images you wish to change.

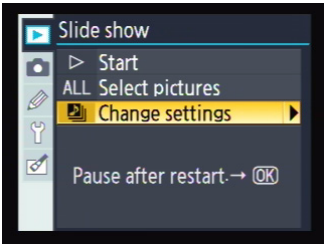
Two types of slide shows are possible: **Standard** and **Pictmotion**.

- **Standard** —each image is displayed full screen for a predetermined period of time (you choose between 2, 3, 5, and 10 seconds).
- **Pictmotion** —each image is displayed using a variety of zoom, panning, and transition techniques (not selectable by you; they're preset to the music) and accompanied by a music track (you choose between five pieces; you'll need to use the Video Out connection to a TV equipped with sound abilities to hear the music).

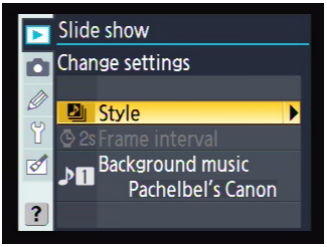
To choose your slide show style (assumes you're continuing with previous instructions):

5. Use the Direction pad to navigate to **Change settings** and press the ▶ key on the Direction pad or

the **OK** button to select it.



6. Use the Direction pad to navigate to **Style** and press the ▸ key on the Direction pad or the **OK** button to select it.

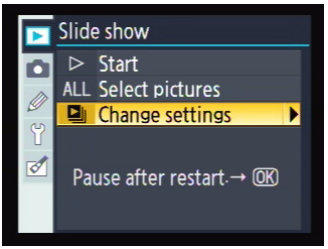


7. Use the Direction pad to navigate to your style choice and press the ▸ key on the Direction pad or the **OK** button to select it.

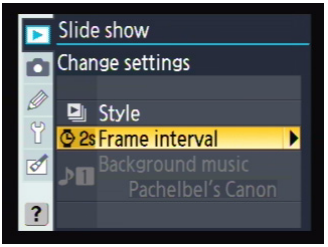
   a. If you picked **Standard**:

      i. Use the Direction pad to navigate to **Change settings** (you should already be there) and press the ▸ key on the Direction pad or the **OK** button to

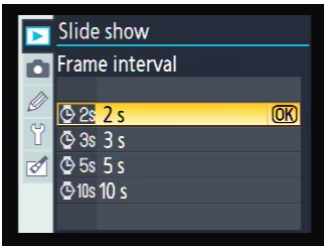
select it.



ii. Use the Direction pad to navigate to **Frame interval** and press the ▸ key on the Direction pad or the **OK** button to select it.



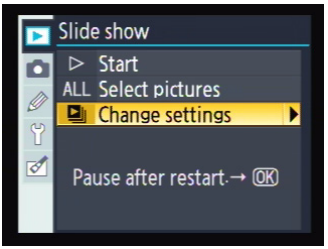
iii. Use the Direction pad to navigate to your interval choice and press the ▸ key on the Direction pad or the **OK** button to select it.



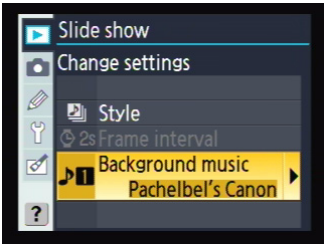
b. If you picked **Pictmotion**:

i. Use the Direction pad to navigate to **Change settings** (you should already be there) and press the ▸ key on the Direction pad or the **OK** button to

select it.



ii. Use the Direction pad to navigate to **Background music** and press the ▸ key on the Direction pad or the **OK** button to select it.

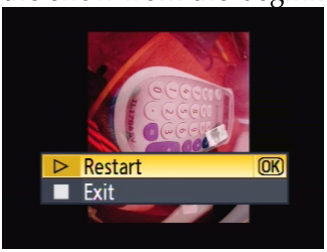


iii. Use the Direction pad to navigate to your music choice and press the ▸ key on the Direction pad or the **OK** button to select it.

8. The slide show is then started by navigating to **Start** and pressing the ▸ key on the Direction pad or the **OK** button.

Slide shows can be paused by pressing the **OK** button (then select **Restart** and press the ▸ key on the Direction pad or the **OK** button to continue), or terminated early by pressing the MENU button (actually, just about any button). At the end of a slide show, the pause display is shown, allowing you to restart

the show from the beginning if desired:



Obviously, if you're using the slide show option you probably are displaying images to others, perhaps in a review session. The D80 supports television display of the images for this very situation (see "Television Playback" on page <591>). Timeouts are handled a little differently in slide show mode, though. The D80 does not power OFF when displaying a slide show unless 10 minutes have passed since you pressed a button on the camera.

Digital Workflow

You need to establish a consistent and repeatable workflow when working with digital images. Here is mine:

- Before going out on a shoot, I make sure that I've already saved all previously shot images on my Secure Digital (and CompactFlash if I'm using another camera that supports it) cards, and then I format the cards I'll be using.
- I always use sequential numbering on my D80 (and D70, D100, D200, D1x, D2xs, and Coolpix, for that matter). But before heading out, I always perform a camera check to make sure that this and the rest of my Custom Settings are set to my desired values.
- In the field, I shoot until I fill a card. I use a small case that holds four cards. When a card is full, I remove it from the camera and stick it in the case face down. I also flip the write protect tab on my Secure Digital cards. Any card I find face down or with the write protect tab set means that it hasn't been downloaded to the computer yet. Cards with the label side up and the write protect tab not set are empty and ready to use.

- I try to carry enough Secure Digital storage with me so that I don't have to perform "field saves," but if I have my portable computer or Epson P-2000 download device with me and need to use a card again, I open my case and transfer all the data from one of the face down cards so that I can re-use it.
- I usually shoot only in NEF format, so when I return from a shoot with cards full of images, I not only need to transfer them to the computer, but also need to have them converted to a non-proprietary format. For each card:
    1. I create a folder on my computer with the location data (e.g., Hawaii Feb 01). With the latest versions of Nikon PictureProject, I simply let it make these folders. For example, I'll create the top folder as something like HAWAIIFeb01 and then let Nikon PictureProject put each card transfer in subfolders labeled HAW001, HAW002, etc. These are my "digital negatives." I usually mark these files with a Read Only attribute so that I don't accidentally edit them in place [151]. (Hint: use the Protect function on the camera.)
    2. In the top level folder just created, I create another folder labeled CAMERA.
    3. I run the batch save and renaming function in Nikon Capture NX to place images from the card folders into the CAMERA folder. These are my working files.
    4. I create a second subfolder under the master called FULL. Whenever I work with an image from the CAMERA folder, I save the Photoshop format result to the FULL folder. Generally, I don't crop this image. Usually, I only perform color and curve adjustments, then touch up any dust using a clone tool. I *never* do

[151] One proofreader of the draft manuscript also suggested write protecting the folder on the computer. This has the side effect of making it so that files can't get moved out a folder, keeping an entire shoot together. I'm not quite that strict with my files, but it's a good idea, nonetheless.

more than a basic sharpening of the image at this point. I try to avoid using levels adjustments, as that changes the data in the file.

5. When I know how I'm going to use the image, I manipulate it again, sizing it, sharpening it, and finally saving it into yet another folder (usually PRINT, MAGAZINE, SLIDESHOW, or WEB). (PRINT is full resolution, cropped, and sharpened for my inkjet, MAGAZINE is full resolution but not sharpened, SLIDESHOW is sized to VGA size in JPEG format at maximum quality, and WEB is sized to 400 pixels maximum in the long axis and saved in JPEG format at moderate quality.)
6. As soon as possible, I save the outer folder (created in Step 1) and all of its contents to a backup drive. If I later make significant changes to images in the subfolders, I'll save a new version to my backup.

Thus, when all is said and done, I can recover the original image and produce versions on demand for several different uses. The structure of my drive looks something like this:

```
Patagonia Feb 01
+---Patagonia0001
    +---PatagoniaFebImage0001.NEF
    +---PatagoniaFebImage0002.NEF
    etc.
+---Patagonia0002
    +---PatagoniaFebImage0125.NEF
    +---PatagoniaFebImage0126.NEF
    etc.
+---Patagonia0003
    +---CAMERA
        +---PatagoniaFebImage0001.NEF
        +---PatagoniaFebImage0126.NEF
        etc.
    +---FULL
```

```
        +---PatagoniaFebImage0001FULL.PSD
        +---PatagoniaFebImage0126FULL.PSD
        etc.
    +---PRINT
        +---PatagoniaFebImage0001PRINT.PSD
        +---PatagoniaFebImage0126PRINT.PSD
        etc.
    +---MAGAZINE
        +---PatagoniaFebImage0001MAG.PSD
        +---PatagoniaFebImage0126MAG.PSD
        etc.
    +---SLIDESHOW
        +---PatagoniaFebImage0001SLIDE.JPG
        +---PatagoniaFebImage0126SLIDE.JPG
        etc.
    +---WEB
        +---PatagoniaFebImage0001WEB.JPG
        +---PatagoniaFebImage0126WEB.JPG
        etc.
```

You'll note one other thing about my workflow: by looking at the file name, I can tell you what stage the image is at or what it should be used for. (My actual filenames, by the way, are a bit more compact and a bit different, as I use a number of abbreviations for camera model, place, and style; but for the purposes of this book, it seemed wise to use longer, clearer names.)

You'll notice that I mentioned a few pieces of software in my workflow description. Notably, I use Nikon PictureProject to transfer images, Nikon Capture NX to convert images, and Photoshop to manipulate images further. The next sections deal with a wide variety of software you might consider using, including those I just mentioned.

D80-related Software

Nikon provides one software product with the D80, a program called PictureProject. As I write this, Nikon produces two programs that work with D80 images (plus a plug-in):

- *Nikon PictureProject*. This is a program that tries to do a little bit of everything with images (transfer, catalog, retouch, show, print, and archive) and manages to do none of it exceptionally. The version that shipped with initial D80 cameras is 1.6.1, which is the current version as I write this.
- *Nikon Capture NX*. Nikon has a 30-day free trial version of Nikon Capture NX that is downloadable from its Web sites. Capture NX is a mature, robust, full-featured raw image converter (indeed, about the best converter I've seen provided by a DSLR maker). This is the program you need if you want to shoot and use NEF images to the fullest.
- *Nikon Photoshop plug-in*. Hidden beneath the PictureProject installer is the fact that it also installs a NEF converter plug-in for Photoshop if it finds that program on your computer. Unlike Photoshop CS2's Raw Converter, the Nikon plug-in is minimal in features.
- If you wish to shoot with the D80 tethered to a computer, you'll need yet another program: *Nikon Camera Control Pro*. This program also allows you to make settings on the camera from the computer, and to transfer things like Custom Curves (see "Custom Curves" on page <519>) to the camera.

Beginning in mid-2006, Nikon began changing its software lineup. What I've mentioned above is what Nikon intends you to use with a D80. Thus, that's the only Nikon software I'll describe in this eBook. Two products—Nikon View and Nikon Capture (the earlier version, labeled with numbers, as in 4.4)—pre-date the D80 and support pretty much all Nikon DSLRs *except* the D80. There is a remote possibility that Nikon may change their mind and add D80 support to those

products (and in the case of Nikon View, there was a Nikon View Pro version talked about, but not yet released).

Note: In the software sections that follow, some screen shots may appear from cameras other than the D80. That's because I try to keep these sections as much the same as possible across my eBooks; the software described is exactly the same regardless of camera. Unfortunately, the Nikon software changes often, and not always in conjunction with a new model, so keeping these software sections current in all my eBooks would be much more difficult if I had to show model-specific screen shots everywhere.

Where a screen shot would make a difference, as with Nikon Camera Control Pro, I'll use D80-specific screen shots, but where you see other models referenced in the screen shots you can assume that the camera model wouldn't make any difference for what I'm showing.

Nikon PictureProject

PictureProject is Nikon's do-all, be-all program, and is provided with everything from Coolpix models to the D2xs. The current version ships with the D80. The ubiquity of PictureProject means that it probably has features you don't need or won't use (e.g. red-eye removal tools), but fortunately the design is decent enough so the ones you don't use don't get in the way of the ones you do.

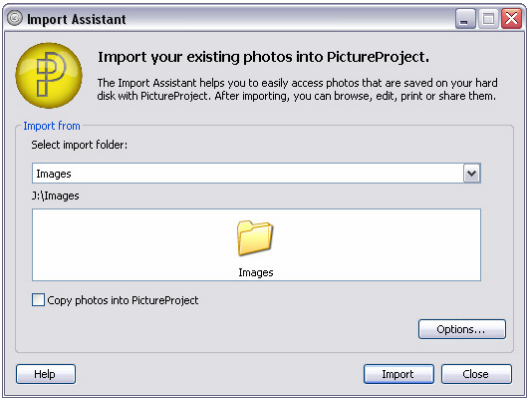
Nikon provided a CD with version 1.6.1 of PictureProject with the initial shipments of D80 bodies. You should always check your local Nikon Web site [152] for newer versions:

US http://www.nikonusa.com
Europe http://www.europe-nikon.com/support

[152] None of these Web sites is set up very well. The Nikon USA site is at best a labyrinth. Here's how to find D80 related stuff: (1) click on the **Digital Tech Support** link under **Photography**; (2) Scroll down and click on the **D80 Set (Body only)** link; and (3) Click on the **Manuals, Guides and Notes** link. If you have a specific question about something, type it in the Search Text box and select **All Categories** (or the appropriate category) from the **Category** pop up. A shorter way to get to this same spot: http://support.nikontech.com.

Asia http://ww.nikon-asia.com
Japan http://ww.klt.co.jp/Nikon

Once you've installed PictureProject, you'll be presented with a screen:



This is the first of many things that may have you initially baffled. PictureProject is an image cataloging program in addition to its other capabilities. That means that it can keep a database of thumbnails and information about your images.

When you're presented with this initial "import" request, PictureProject is asking if you'd like to bring your existing images into its cataloging system. If you choose to check the **Copy photos into PictureProject** box you'll not only get the cataloging capabilities, but PictureProject will be working on copies of your images rather than the originals. That's a double-edged sword. If you make copies, you'll be chewing up drive space; if you don't, you could accidentally make changes to your original files.

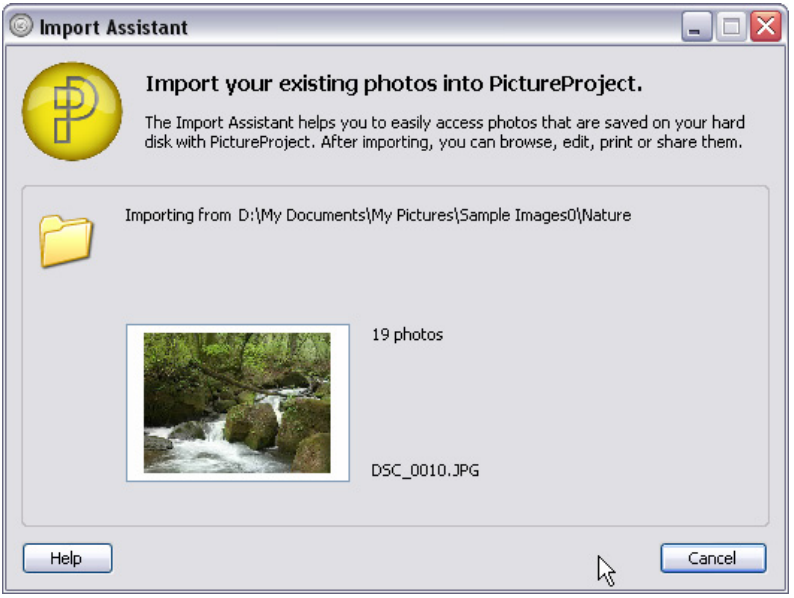
This is probably the point where I should make a comment about PictureProject's suitability for pro users. Better cataloging options exist (see "Catalog Programs" on page <684>). PictureProject is obviously a work in progress, and it's unclear in my mind if it will eventually make it past the ACDSee level of program (capable, with good performance)

let alone up to the Extensis Portfolio level of product (comprehensive, with great performance).

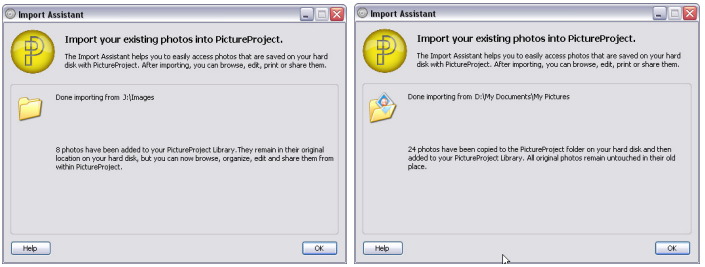
If you're getting the idea that I'm not a fan of PictureProject, you're correct. It has rough edges, can chew up resources, uses yet another new UI design [153], isn't particularly well-documented, and isn't better than other choices already available. Still, it does a modest range of things decently, so this initial import screen is an important decision point. Fortunately, you can defer to import later (choose **Import** or **Import Assistant** on the PictureProject **File** menu—for newcomers to PictureProject, I suggest **Import Assistant**, as it has clearer wording and options).

During an import session (which can take a long time if you've got a lot of D80 images to catalog), you'll see a progress screen (top is without the assistant, bottom is with):

[153]Yes, the primary Nikon software products all have distinctly different UI designs, which is silly.



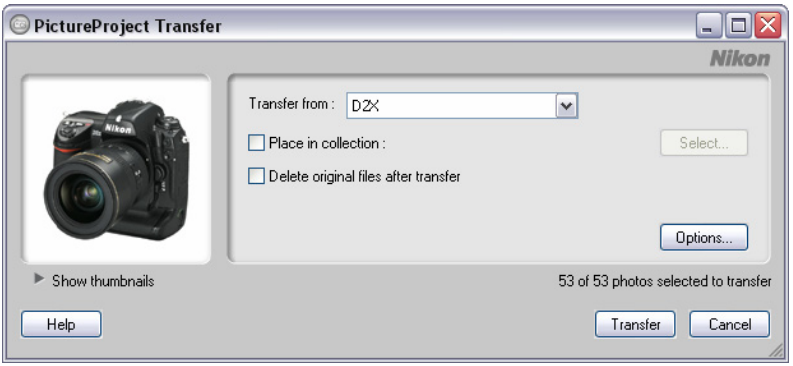
After you've imported your images with the assistant active, you'll get a second screen:



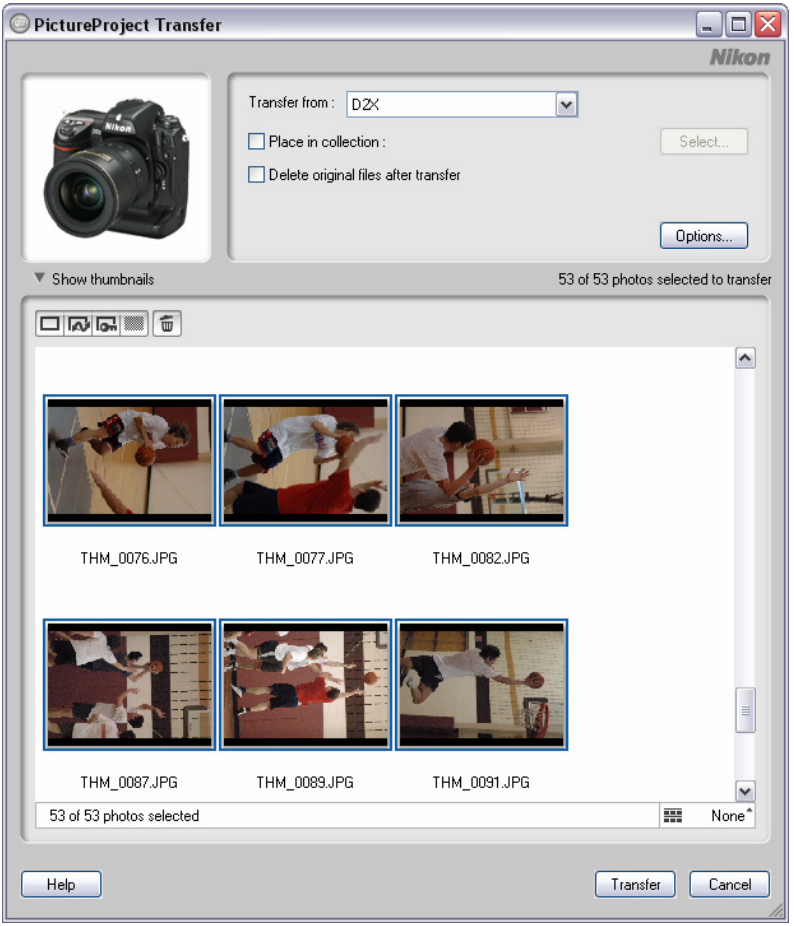
On the left is what you see if you didn't copy the images, on the right is what you get if you did. I've elected to show this screen because the information in the box is important: note the comment "**They remain in…**" versus "**remain untouched.**" This may not seem like a big distinction, but it is: the first means the PictureProject library is still referencing the files in their original location, while the second means that your originals are safe in their original location and the PictureProject library will reference copies.

Why is that important? Because PictureProject (or Capture NX) can make changes to the files you're working on. If either program touches your originals with any sort of alteration, your original files can and will get changed. So my first recommendation with PictureProject is to always copy your files, even though this doubles the amount of hard drive space you need.

Okay, the files we've already shot are already being tracked by PictureProject after an import, what about new ones we shoot? PictureProject has a "transfer" function that should automatically pop up when you connect your D80 to the computer or put a card with D80 files on it into your computer's card reader (here shown connected to a D2x, not a D80; the only things that change with different Nikon cameras, including Coolpix models, are the camera picture and the **Transfer from** location):



This is one very useful function. Note the **▸Show thumbnails** option underneath the picture of the camera (which will change to whatever Nikon camera you have connected to the computer, by the way). Click on it and the screen expands to:



PictureProject has grabbed the thumbnails from the camera and shows them to you (if you've got a lot of images on the card, PictureProject may briefly show "**now enumerating**" while getting the thumbnail info).

Look just above the thumbnails and you'll see a toolbar:

From left to right, these transfer tools are:

- Select All—all images in the current folder will be transferred.
- Select Marked—only those images that are "marked" will be transferred. By marked, Nikon means images with the "mark" tag (in the Properties palette).
- Select Protected—only those images that have been protected (🔑 key on the D80) will be transferred.
- Deselect—deselects all images (no images are selected for transfer)
- Delete—Deletes the currently selected image(s).

Yes, this all means what you think: you don't have to do a brain-dead dump of everything on the card to your computer anymore: you can pick and choose only those images you want to transfer (and note also the **Delete original files after transferring** option, which can be another time-saver).

We've got one more thing to mention before we move on from the transfer function: collections. You may have noticed the **Place in collection** option. PictureProject is organized in this fashion:

Library
    Collection1
    Collection2
    Collection3
    and so on…

Okay, that was too simple. Collections can live in folders, so a better example might be:

Library
    Folder1
        Collection1
    Folder2
        Collection2
        Collection3
    and so on…

Image files can live generically within the library, or within collections (you get to name collections and folders—I've used generic names here). You can create collections or folders at any time and then drag your images into the collection (and collections into folders). This all sounds more complicated than it is:

- *Library*: all images being tracked by PictureProject.
- *Folder*: an arbitrary organizational tool into which you can stick collections (and other folders, and even individual image files). Folder in this context is the same as you're used to with your computer's file system, only these "folders" are really only seen by PictureProject.
- *Collection*: a special type of subfolder that contains a group of related images.

You can also have PictureProject run images directly into collections during the transfer from camera to computer. Just check the box and then click the **Select** button to choose which of your existing collections you want to assign the images to.

There are plenty of ways to organize collections. PictureProject's default behavior suggests that each card import could be a collection (you'll see an automatic collection called **Last Import**), but that's just one way of organizing images. You could build collections for places, events, assignments, people, and just about any other category of image you might create. You're on your own here: if you use PictureProject, you'll want to use collections to keep from just having one big scrolling window of images and because huge collections tend to diminish performance, so start thinking about the logical ways to organize your shots from the very first time you use PictureProject.

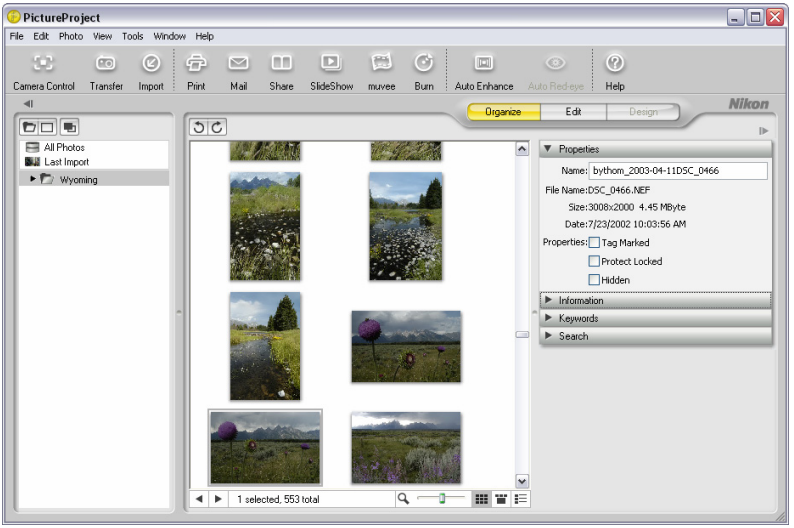
PictureProject supports a number of things to do with folders and collections, but the most powerful things are these:

- *Find pictures*—Select one or more collections (or folders) in the left panel (collection list), then open the **Search**

palette (click on the ▸ next to **Search** in the palette list on the right of the main **Organize** screen). You're then able to search for images by name, keyword, date, and tag, and whether they're protected or hidden. Of these, keyword is the most powerful, but only if you've been assigning keywords to images as you transfer and catalog them.

- *Sort pictures*—Select **Group by** in the **View** menu and then pick one of the attributes (**None**, **Shooting Date**, **Import Date**, or **Extension**).

Once you've imported or transferred images into PictureProject (and perhaps sorted or found them), you'll be looking at the program's main screen:

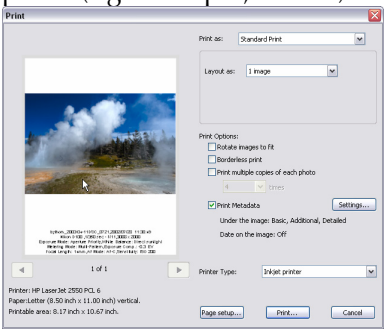


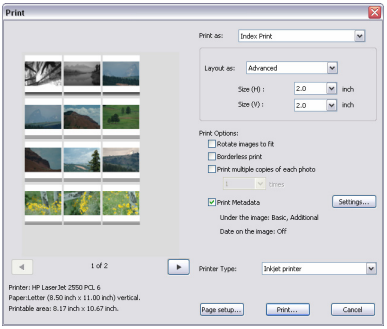
We've got a lot to deal with here, so let me step you through main items to note.

First up, Note the yellow button (the selected item in a fancy tab system). You'll normally be on **Organize**, which is where you browse through and find images to work with. The second option is **Edit**, which gives you access to a modest number of photo enhancement tools.

Just below the menus you'll see a toolbar (on Windows machines you can right-click and select the options of how the toolbar appears). Most of these items are simply shortcuts for things in the menu system. Let's go through these one by one:

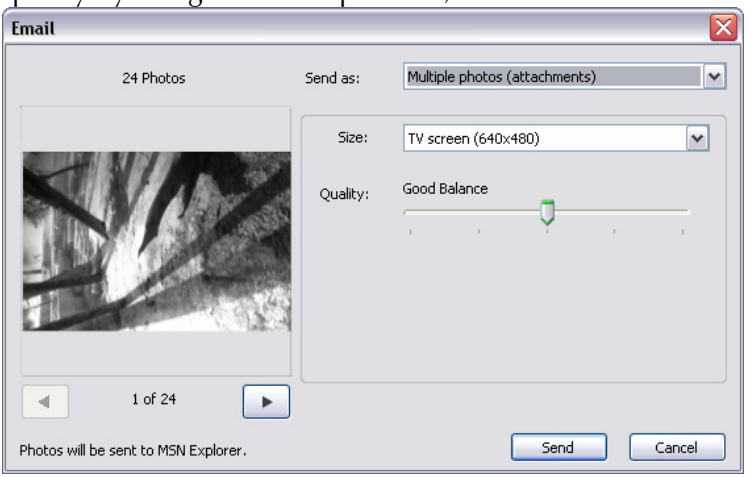
- **Camera Control**—invokes Camera Control Pro's camera control module (if Nikon Camera Control Pro is installed).
- **Transfer**—invokes the camera/card to computer transfer function I just got through describing.
- **Import**—shortcut for the **Import** menu command (not **Import Assistant**) on the **File** menu.
- **Print**—takes you to the Print dialog for the selected images. PictureProject supports a number of options, including borderless prints (which may end up cropping the long axis), adding EXIF data to the print (left sample, below), and index prints (right sample, below).



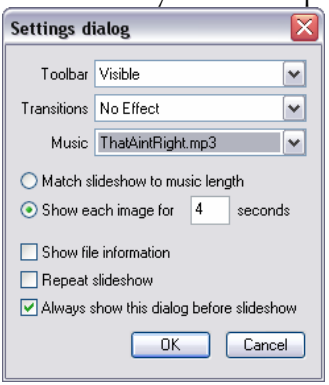


- **Mail**—Presents an Email dialog that allows you to prepare the selected images for being sent via email (which may require converting to JPEG, resizing, or downgrading the

quality by using more compression).

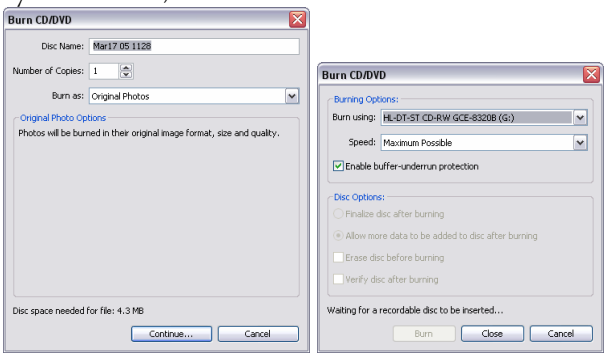


- **Slideshow**—This is your basic slideshow tool. Select images and click it and you'll be presented with a set of options. Unfortunately, this function is easily overwhelmed and it's easy to crash or stall the machine, at least in my limited experience with version 1.6.1.



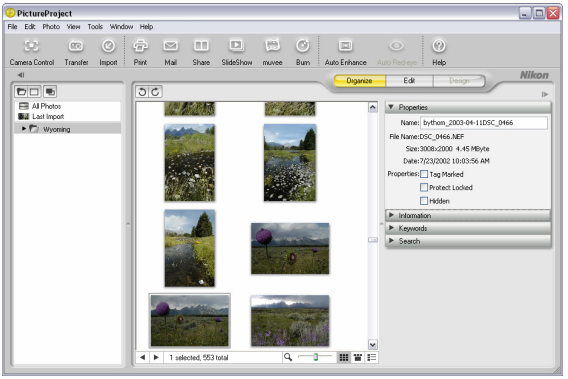
- **muvee**—A different option than **Slideshow** for making presentations. Muvee uses some external software to make a movie of your slides. Movies can be emailed to others, burnt onto CD or DV, and played on other machines without the PictureProject software.
- **Burn**—Brings up a series of dialogs that allow you to copy the selected images to CD-R (or DVD-R if your

system has it).



- **Auto Enhance**—A bit like performing Auto Levels in Photoshop, this option examines the selected photos and attempts to adjust exposure, sharpness, and even shadow detail automatically. Like most "auto" procedures, this one can be hit or miss, but it's worth trying. (Note that you can compare the before and after result of this tool by selecting the image, clicking **Edit**, opening the **Markers** section and then going back and forth between **Original** and **Current**.)
- **Auto Redeye**—This auto function is a little more helpful, since it works pretty well. If you've got an image that has the dreaded red-eye effect from flash, select it and click on this tool and the problem will be remedied automatically.
- **Help**—Brings up the Windows or Macintosh help system with information about PictureProject.

PictureProject supports several different ways of viewing thumbnails and previews in the **Organize** tab:



Thumbnail

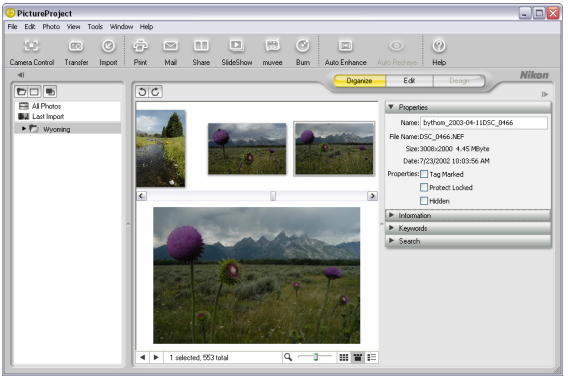
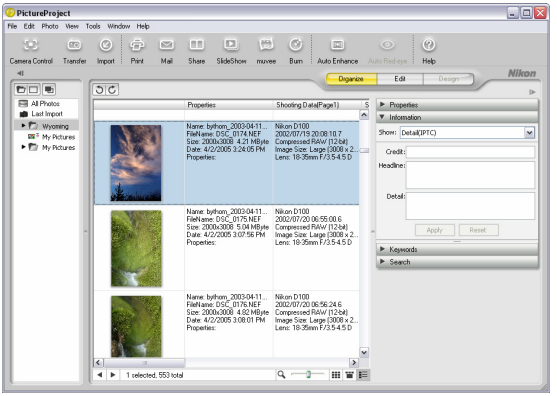
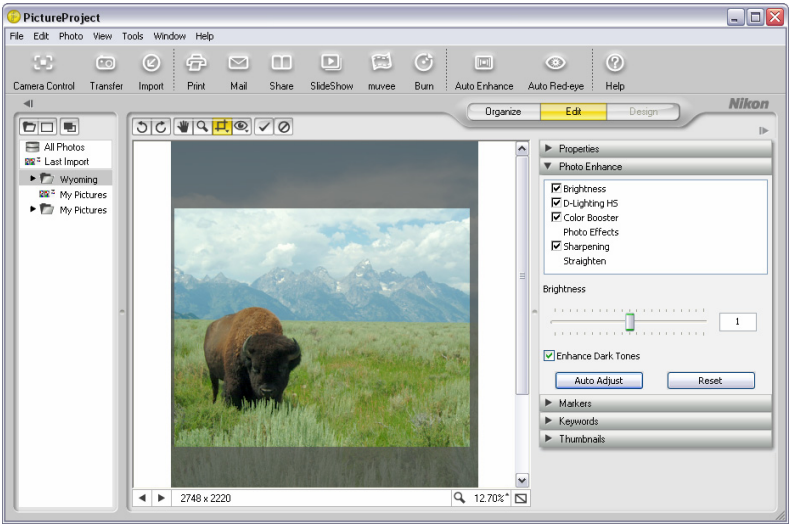


Photo &Thumbnail



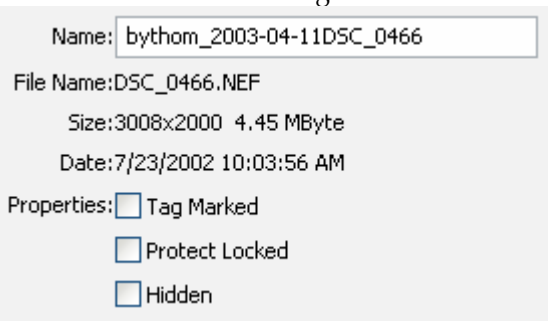
List

Next, select an image (or images; but for now, just select one) and click the **Edit** button.

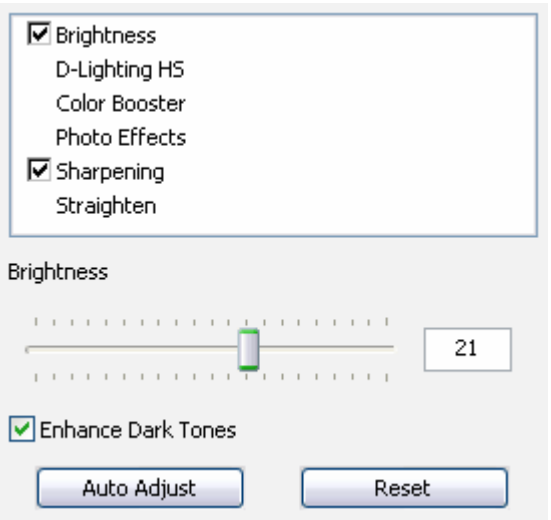


There are three important areas to point out here:

1. In the palette area at the right, the top area is labeled **Properties**. When expanded, this area is where you "mark" images (**Tag Marked**). You can also protect and hide them and reassign the name.



2. The second palette area is labeled **Photo Enhance**, and has a number of basic image manipulation tools:



These tools should be pretty obvious as to what they do, and none have the complex setting capabilities you find in Capture NX or Photoshop.

3. Just above the image is a set of additional icons:

In order, these tools are:

   a. Rotate counter clockwise 90 degrees.

   b. Rotate clockwise 90 degrees.

   c. Move area being viewed.

   d. Magnify image area being viewed.

   e. Crop.

   f. Redeye removal.

   g. Accept changes (equivalent to the **Ok** button in most dialogs).

   h. Cancel changes (equivalent to the **Cancel** button).

Overall, though, I don't think you want to be using PictureProject to edit your images—its facilities are just too primitive compared to what you find in products like Photoshop Elements. Moreover, PictureProject's performance

with large numbers of images leaves something to be desired. Worse still, if you opt for Capture NX, you get much of the image browsing ability that is the core of PictureProject; about the only thing you'll miss are the transfer-to-computer functions. Indeed, that's the only component of PictureProject I actually use.

If you want a recommendation, here it is: don't install PictureProject. Instead, purchase Capture NX to get good raw conversion functions and then look at one of the many other options for moving images from camera (or card reader) to computer. On a Macintosh, those would include:

- iPhoto (http://www.apple.com/ilife/iphoto)
- Image Ingester (http://www.basepath.com/ImageIngester)
- Adobe PhotoElements (http://www.adobe.com/products/photoshopelmac)

For the Windows user:

- Downloader Pro (http://www.breezesys.com/downloader/index.htm)
- Digital Pro (http://www.proshooters.com)

Many other programs also have camera-to-computer transfer abilities. These are just some starting points to consider. You could also just use PictureProject to transfer, as I do.

Nikon Capture NX

In mid-2006 Nikon introduced a completely rewritten version of Capture, called Capture NX. The older version, usually referred to as Capture 4.x, predates the camera and thus *does not* support the D80. By default, therefore, Capture NX is the Nikon raw converter of choice for D80 users (earlier Nikon DSLR users can use either version of Capture).

Nikon Capture provides support for critical viewing and image manipulation of D80 NEF (and JPEG) format files. Capture NX is currently at version 1.0.1, and all examples and menu descriptions here assume that version (it's the first

version that supports the D80; so make sure you have version 1.0.1 or later).

Note: Capture NX can work with any type of image the D80 can create. In this section I'm going to mostly talk about converting raw images (NEF files), because that's the primary function that usually attracts someone to download and try Capture NX.

Nikon has a free 30-day trial version of Capture NX that you can download from the Nikon Web sites. I strongly suggest that you load this into your computer and try it. While Capture NX is quite different in user interface than most software you're used to, it's easy enough to learn and it has features you won't find in other products.

While I think Nikon should have provided Capture NX with the camera—Nikon's software is much more mature than the competitor's, so it's a potential selling point—the program has undergone considerable revision and refinement since its ancestor first appeared early in the DSLR era. That refinement probably wouldn't have happened without the added revenue.

Capture has one primary and several secondary roles:

- (Primary) Converts NEF files into usable images (JPEG, TIFF, direct Photoshop transfer).
- Edits JPEG and TIFF images.
- Provides a basic image browser, including viewing of EXIF data.
- Allows entry and editing of IPTC data.
- Allows batch processing of multiple files.

Plenty of competitors exist for the first function (see "NEF Converters" on page <676>"), though Capture NX holds its own against all comers. What is unique in Capture NX is the "control point" concept. Basically, you create a control point, modify the area it applies to, then manipulate an image

parameter in the area via a set of sliders on the control point (or in a tool palette area if you need finer control).

Basically, the idea behind control points works like this: *things like this (the pixels at the control point) should be changed to…* Sounds pretty basic, doesn't it? On the surface, it is, but it's also a powerful concept that has wide ranging implications on how you manipulate aspects of your image.

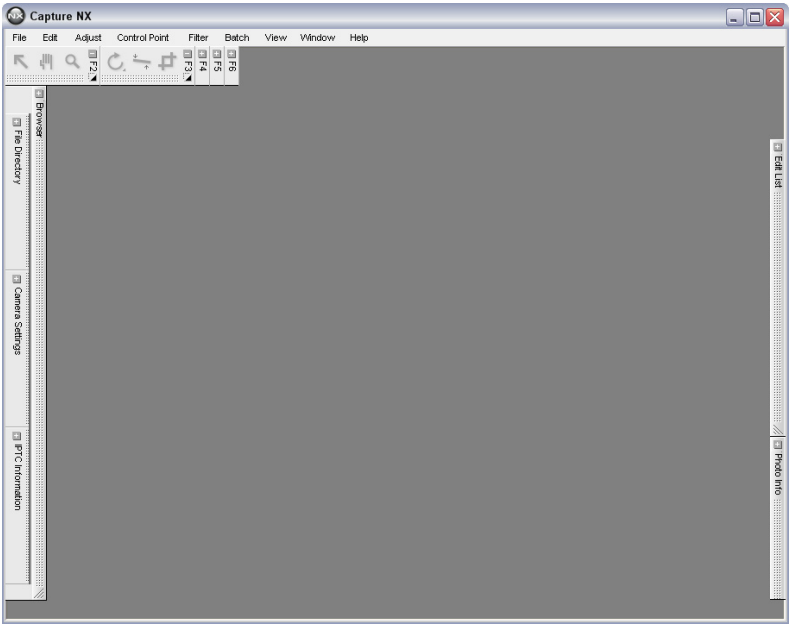
Note: This section is not intended to be a full tutorial on how to use Capture NX. I'm merely interested in introducing you to the concepts and abilities of the program, as it is a potentially useful option for any D80 shooter that wants to get the highest possible image quality out of their camera.

So I'll repeat: take a look at Capture NX. I'll bet that most of you will find that there's something there that is useful and worth the money. (And if you don't, I'll bet that you found that one of the other converters I describe beginning on page <676> is the reason you didn't.)

The Capture NX User Interface

In this day and age of well-established user interfaces, Capture NX has gone and done the improbable: reinvented the way everything works. So, before we get into the primary features of the product, we need a quick tour of the UI widgets you're going to encounter, and how they work.

When you start Capture NX, you get a rather strange-looking window:

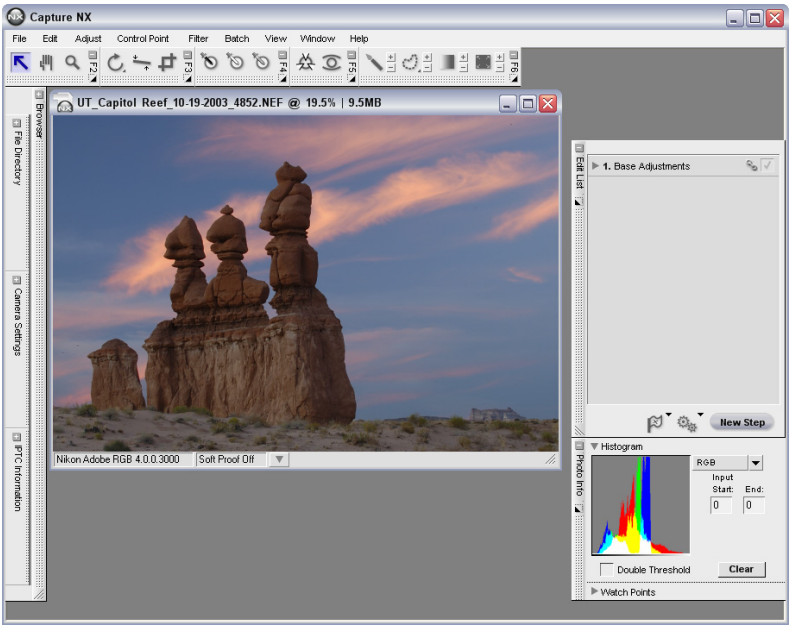


The menus at the top of the screen shouldn't need explanation, but the rest probably does. Just below the menus is a horizontal bar that has multiple windows, each of which contains multiple icons (not always visible). There are several things to note about the icon windows:

- Each window is named (**F2**, **F3**, etc.). In the case of the icon tool windows, those names are the same as function keys. Pressing the function key toggles display of that window on and off.
- You'll see a or a icon (in all Capture NX windows, but here we're starting with the icon tool windows). The minimizes the window while the opens and maximizes it. In the icon tool windows you'll see that **F2** and **F3** are maximized, while **F4**, **F5**, and **F6** are minimized (as are all the other windows arrayed around the edges of the Capture master window). Click the icon to change the window size.

- Each window has a grab handle area ( ). Click and drag the grab handle area to move a window from one position to another on the screen.
- There's also a docking icon ( ) that appears with each window. This allows you to dock windows together or separate them to another position on the screen (you can also drag them using the grab handle). Click on the icon to dock or undock the window.

You might have noticed that the icons are grayed out in the initial window I showed. When you open an image, the icons now go active and you may see additional windows open (from the sides):



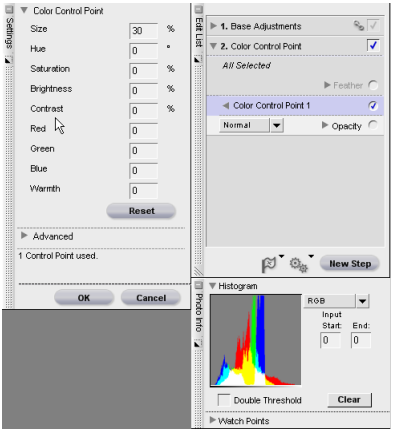
Now the icon tools that are appropriate for our current state are activated, plus we (normally) see to windows on the right open up: the **Edit List** and the **Photo Info** windows. Note that the user interface items I mentioned before (docking icons, grab handle area, etc.) are present in these windows as well as the windows containing tool icons (and you're going

to see them yet again in other windows in a minute). While the Capture NX user interface is unusual, it is consistent.

But I'm getting ahead of myself. Those two new windows revealed several new user interface widgets you need to recognize:

- While it sometimes appears in unusual corners of windows (the Windows norm is the lower right corner, not the lower left as shown here), the window resize icon is another way to work with the various windows Capture NX presents. Click and drag it to resize the window in question.
- Some tools can have their complexity hidden or revealed. Note, for example, that the **Base Adjustments** tool in the **Edit List** window is closed ( ) while the **Histogram** tool in the **Photo Info** window is open ( ). Just click the icon to open and close a tool.
- Special icons appear sometimes in windows. The little triangle next to the icon indicates that there's a pop-up menu (multiple choices) associated with the icon. Click on the icon to reveal the menu, and use the menu as you normally would.
-

Finally, there's two other things that sometimes appear with tools. Note the ◀ icon on this tool. That indicates that it has been opened and that there is a sub-window of *additional* options that is now open for you to make changes in, as in this example:



Note the name **Color Control Point** on the left-hand **Settings** window and on the second "step" in the **Edit List** window. Yep. The **Settings** window applies to that step, and the little ◂ icon is what is supposed to key you into the fact that a **Settings** window for that tool is open. Click on that icon to open and close the **Settings** window.

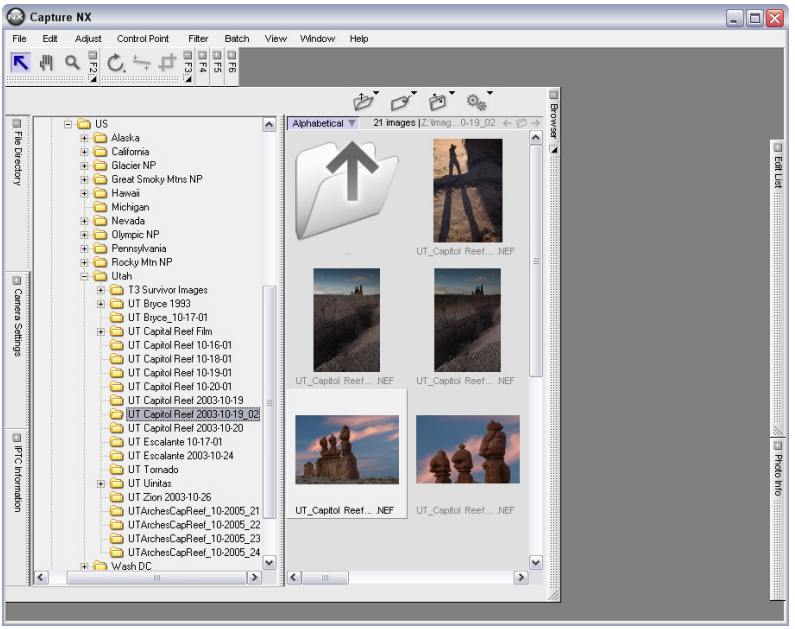
The other aspect to note here is the box with the check mark in it. "Boxes" can be square (master) or circular (sub-item). Thus, you can turn off sub-items within a master control (but not vice versa). Here, the **Color Control Point** master item is checked, and within it, the **Color Control Point 1** is checked. This hierarchy might not make sense at this point, but believe me, this is a useful ability, as you can tweak individual aspects of a tool (like **Opacity**) or turn the whole tool on and off as you review the effect it having on your image. Click in the box to turn the check mark (and effect it controls) on or off.

Not so scary, is it? Indeed, there *is* a strong consistency in the Capture NX user interface. Once you learn a few widgets and how they work, you've mastered the user interface. On the other hand, what bothers some people about the interface is how *many* windows and sub-windows you have to deal with to perform a simple raw file conversion (that's one reason why you need widgets to open, close, and move them!). And as you get more complex in your image editing, it seems that

you end up dealing with even more windows and tools. On a smallish monitor, this can overwhelm the actual image preview. But the same thing was once said of Photoshop. The solution? Get a bigger monitor with more pixels. Capture NX feels cramped on my laptop, but is more pleasant on my big desktop screen.

Managing Images

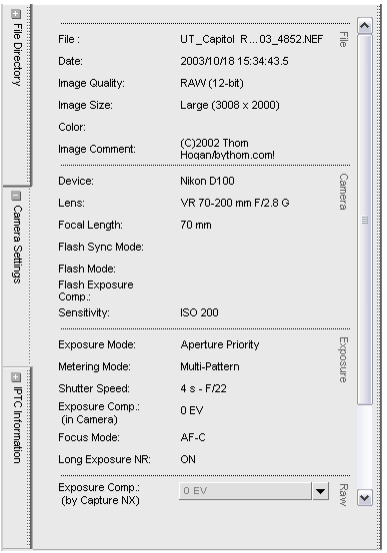
Let's start our discussion of features with one of the secondary functions of Capture NX, because that's usually where you'll start using it. In the user interface discussion, above, I didn't open the tools on the left side of the screen. Let's do so now:



Along the leftmost side we have the **File Directory**, **Camera Settings**, and **IPTC Information** windows, and next to them we have the **Browser** window. You can, of course, just use the **Open** function on the **File** menu to get to an image, but when you've got as many images as I have, often you need to browse or search to find them.

Because of the structured manner in which I save images, that usually means that I use the **File Directory** to find the right location in my file structure, then use the **Browser** window to find the exact image I'm interested in. So I click open both windows and "browse." These windows, once open, should be reasonable familiar in use to any computer user; pardon me if I don't describe how they work.

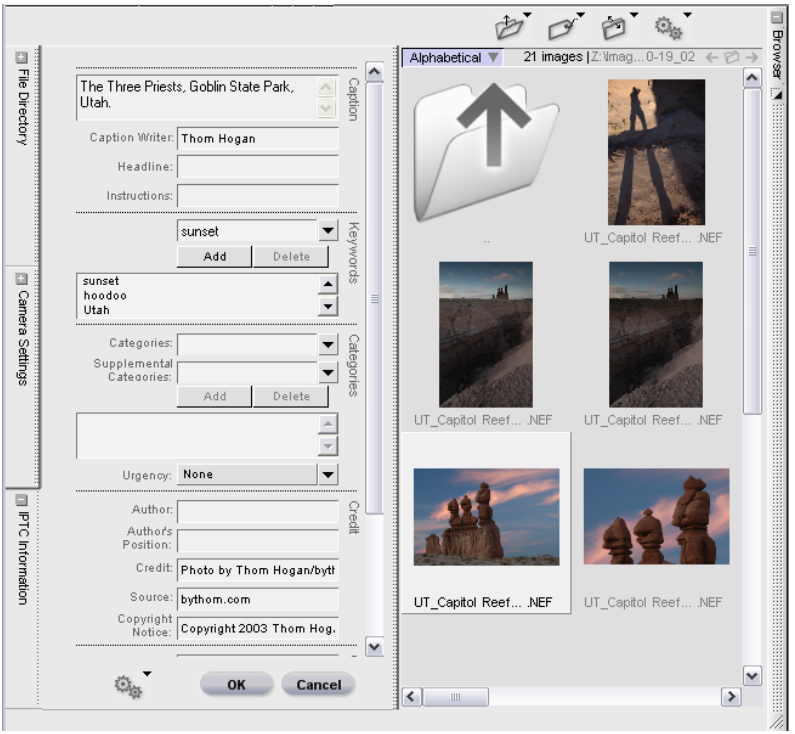
The **File Directory**, **Camera Settings**, and **IPTC Information** windows are mutually exclusive: only one of them can be open at a time. Here's what the **Camera Settings** window looks like:



If that looks like EXIF data to you, bingo, you've won the prize for paying attention. That's exactly where this information comes from. Thus, Capture NX is also a good way to examine photos and learn from them. All your 1/15 second photos look unsharp? Hmm, maybe you can't handhold the camera at that shutter speed. Always using the 70-200mm VR lens at 70mm? Hmm, maybe you'd be happier with a smaller lens, like the 60mm f/2.8 or 85mm f/1.8. Try it. Spend an hour or two browsing through the EXIF data from all your images and

I'll bet you that you *do* learn a thing or two about how your camera and you get along.

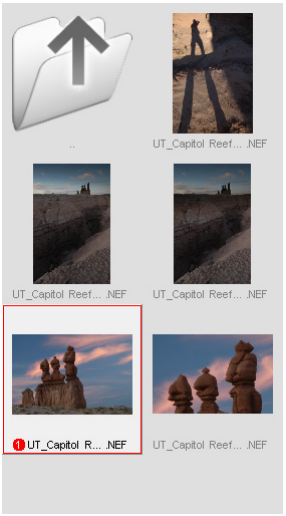
Here's what the final window along the left side looks like:



You'll note I've added Keywords, a Caption, Credit and Copyright information to this image. With as many images as I have, that could take awhile to do, but I'll give you two hints: (1) use a transfer program for moving images from card to computer that allows you to pin static IPTC information to all your images (Credit, Copyright information for me); and (2) use the user interface you learned about! That icon reveals the ability to **Copy Settings**, **Load Settings**, and **Save Settings**. That means you can apply the same data to other images more quickly than just typing.

Before we leave browsing portion of the interface, I should point out one more useful feature: prioritizing. Up there on

the top of the **Browser** window is another useful icon: , or the Tag icon. When I use it to "tag" an image as **1 Good**, look what happens to the image display:

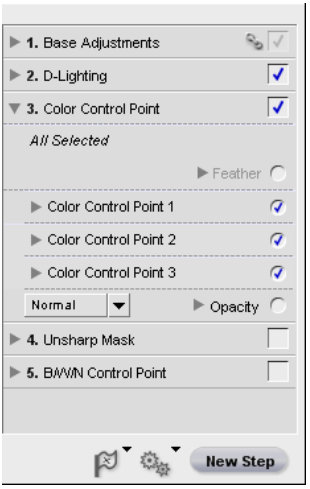


Note that I've now got an image with a red 1 tag on it. If I do this for all my images (and you can change the tags and the meaning of them), I can now *sort* the **Browser** window by tag. Obviously, I'll want to see all my **1 Good** images first!

Manipulating Images

Let's move on to the primary function of Capture NX: image manipulation.

Before we go further, let me point something out: the Edit List is our primary focus as we manipulate images.



This list is a series of steps (and in some cases, like the multiple control points in the above example, a series of sub-steps) where we make changes to our images using the various tools Capture NX has to offer. Steps, as you might guess, are performed in the listed order. If Capture NX has a weakness, it's that you can't drag steps into new orders. Also, **Base Adjustments** can't be anything other than the first step (and if it is active, then the performance of the program will slow down a bit). Thus, you need to think about the order in which you make image manipulations. Generally, that order is:

- Straightening
- Color
- Exposure
- Sharpening
- Cropping

One could easily argue that other orders are also valid, but the point I'd make is this: decide on the order before you start your manipulations, as Capture NX doesn't really give you

any easy way to change the order [154], yet the order implies how the underlying pixels are manipulated. The **Unsharp Mask** tool, for example, will apply to pixels as rendered by all the steps that come before it. As I noted earlier about sharpening, this tool changes pixel values at edges. You don't want to change those values at edges first and then later try to manage those same pixels for, say, brightness.

Okay, with that caveat out of the way, let's delve into the tools. Wait, where are they? Good question. Capture NX doesn't have a large tool palette like a number of programs (including its predecessor, Nikon Capture 4.x). The primary tools are found in the following places:

- The icon windows
- The **Adjust** menu
- The **Control Point** menu
- The **Filter** menu

Some of these overlap (there's both an icon window and a menu for control points, for example), others only appear in one place (critical selection tools only appear in the **F6** icon window, for example). A few additional tools appear in the **Edit** and **View** menus.

I could easily expand the Capture NX tool discussion to an entire book. Instead, I'll explain one critical tool concept at length—the control point—and then just briefly touch on the others.

Control points are one of the key concepts in Capture NX. Basically, establishing and changing a control point is akin to saying "pixels like this one, within this area, should be changed to this." In other words, you point at a pixel, establish the area you wish your changes to apply to, then

[154] There's a crude ability to copy and paste Edit Steps, but it's cumbersome and you can't always make the types of changes you'd like (if multiple control points are in a single step, you can't change their order, for example).

make some changes. Let's take a look at how the control point looks on the screen:

Before control point

After control point

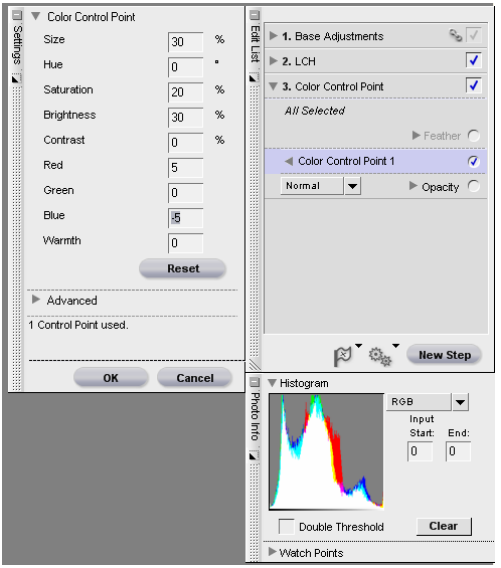
In this case, I've picked a **Color Control Point** (from the **Control Point** menu) and placed it on the rock across from me. The control point itself is a white dot:

The things sticking down from that are a shorthand list of changes you can make (by dragging the black dots left and right). From the top, they are:

(main control point) Radius
Hue
Saturation
Brightness
Contrast
Red channel
Green channel

Blue channel
Warmth

If you don't want to use the sliders, you can open a **Settings** window from the **Edit List**:

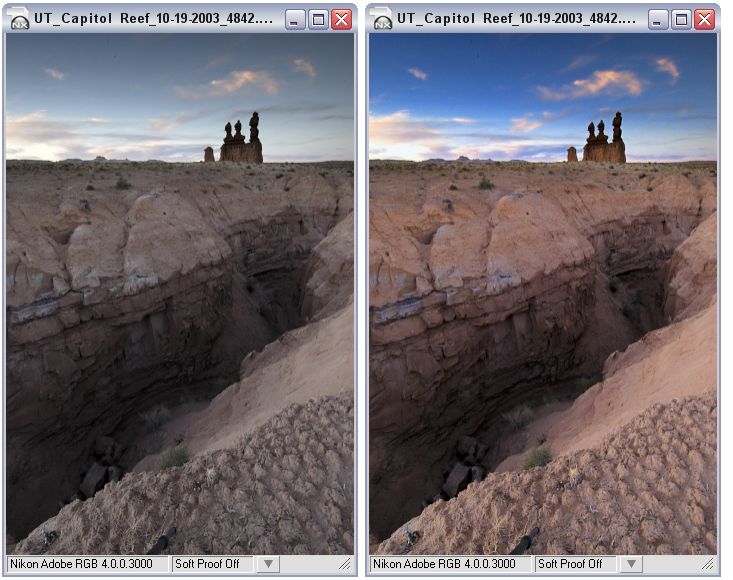


Note that Step 3 in the **Edit List** is "**Color Control Point**" and that we have the ◂ indicator to show that the **Settings** window applies to that. If you type values into the **Settings** window, you'll notice that the black levers in the main window move in conjunction (and vice versa).

So, what I've said with this control point is the following:

For pixels that look like my chosen point within 30% of the image (radius), increase saturation by 20%, brightness by 30%, red values by 5%, and decrease blue values by -5%.

Here's what just two control points allowed me to do with the image we just looked at:



Pretty powerful little tool, right? You bet it is. But what catches most people is that the control point seems to apply to a circular area. How do you make it apply to something other than a circle? Simple:

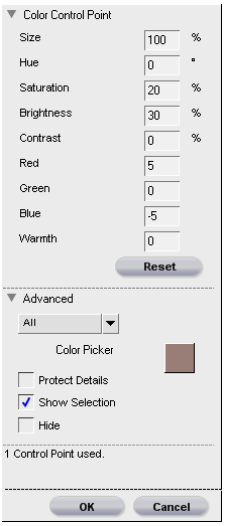
1. Increase the radius so that the target circle encompasses the entire area you wish to manipulate.
2. Use the selection tool to choose the area you're going to make your selection in. (Note also that the selection tool shape can be changed from lasso to polygons to marquee to ovals. Click and hold to see the other options.)
3. Use the selection brush to choose the actual area within the selected area that you wish the effect to apply to.

This seems a little backwards and convoluted to Photoshop users (where you first select the area directly, then select the effect). Yes, it is. Moreover, you might be tempted to use the lasso or marquee selection tools (Step 2) and then be perplexed as to why the control point effect isn't applied to

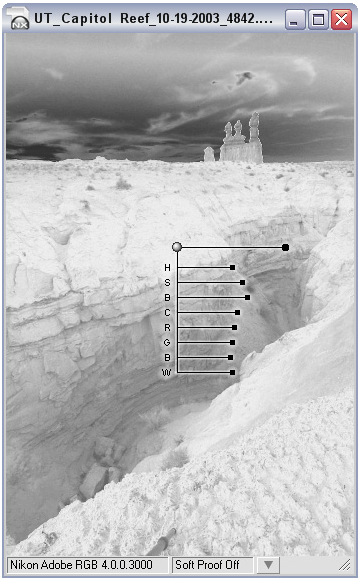
the area that you just defined. Again this is behavior unlike Photoshop: with Capture NX the lasso and marquee selections are just ways to limit the area *in which the* selection brush (or a gradient, etc.; Step 3) is applied.

You have five types of control points to choose from (color, white, black, neutral, and red-eye), plus you can create as many control points as you need. To remove a color cast from an area you'd use a neutral control point, for example. But then you might also add white and black control points elsewhere in the image to define the brightest and darkest areas. Later, you may apply multiple color control points to modify colors in an image (to see how multiple control points work, see "One Image Processed by Capture NX" on page <654>).

For the most part, control points will be one of the major tools used on all your images. Indeed, they might be the *only* tool you need to get your images to look the way you want them to. Before I leave control points, I need to point out something that escapes most Capture NX newcomers: you can see the selection to which the control point applies!



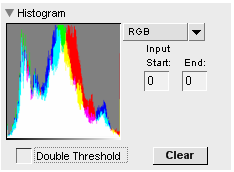
In the **Advanced** section of the **Settings** window for a control point you'll see **Show Selection**. Check that box and watch what happens:



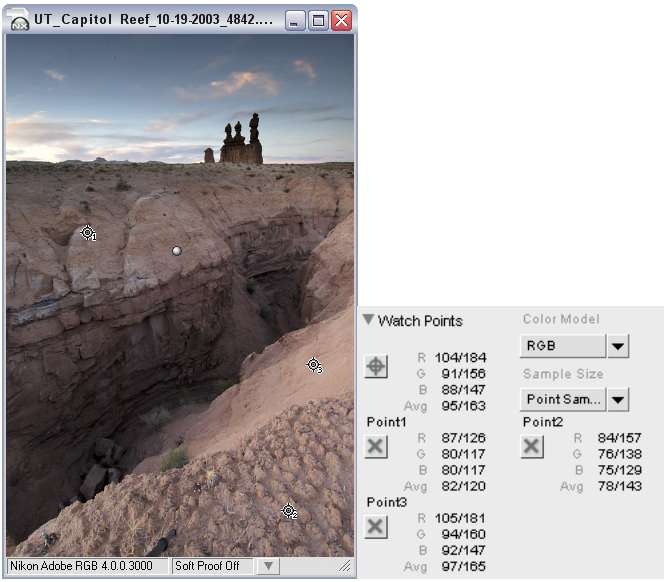
The control point changes will be made to "white" pixels in this view, but not to "black" pixels (in between pixels get proportional changes). Remember, you can use the selection brush to narrow the area in which the changes will be made. In this particular image, I might want to select only the foreground, so the sky doesn't get modified by my control point.

As I noted earlier, Capture NX has a wide range of other tools. In the remaining portion of this section I'll briefly introduce you to some of them.

The **Histogram** tool (in the **Photo Info** window) is the least interesting, as it's function is duplicated in several other places in Capture, still, you'll usually want it visible:



The **Watch Points** tool (also in the **Photo Info** window) is very interesting: at any time you can add a "watch point," a fancy way of saying that you can positions on the image so that you monitor their values. Here's what my image looks like with three watch points marked:

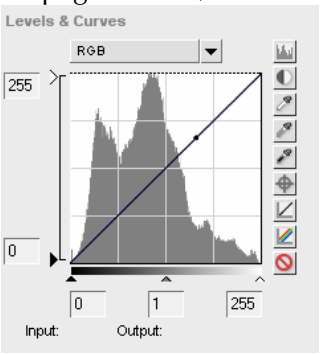


Capture NX allows you to make a number of modifications to images. You may:

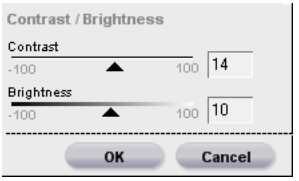
- *Select a portion of the image to output.* Select the crop tool (in the **F3** icon window). Click on the upper left boundary you want to crop to and, holding the mouse button down, drag the mouse to the lower right boundary you desire. This tool confuses some new users, since they expect to see portions of the image removed when using crop (the way many digital imaging programs work). Capture NX doesn't actually throw anything away until

you save, however. And you can move the boundaries of the crop at any time by dragging them to a new location. (Double click outside the crop to cancel it.)

- *Adjust overall brightness and contrast.* Select **Levels & Curves** from the **Adjust/Light** menu (or press Ctrl-L). Now adjust your white and black point and modify the contrast curve. Curves and level adjustments are a subject worthy of their own article. For a brief discussion of the important issues, see "Manipulating Levels and Curves" on page <681>).

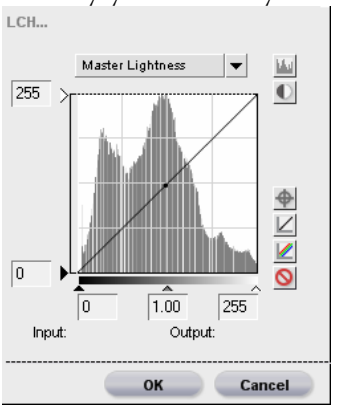


Or select **Contrast / Brightness** from the **Adjust/Light** menu:

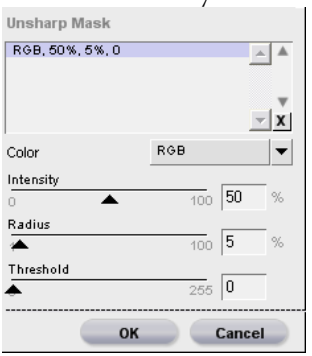


Believe it or not, there are even more ways of getting Capture NX to do the same thing: select **LCH** from the **Adjust/Color** menu and use the **Master Lightness** tool

the way you normally use the **Levels & Curves** tool:

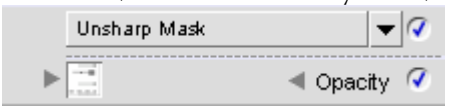


- *Sharpen the image.* Select **Unsharp Mask** from the **Adjust/Focus** menu. Adjust the **Intensity**, **Halo Width**, and **Threshold** values by dragging the sliders or entering numbers directly to the right of the sliders.



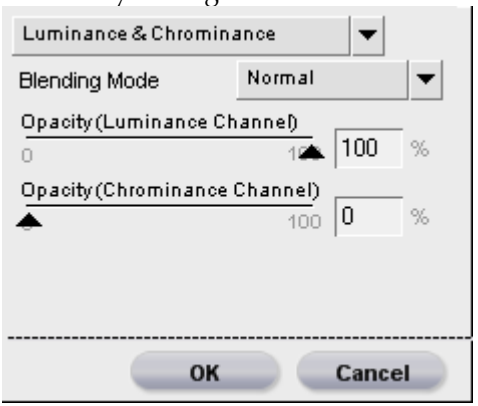
If you're going to use this tool, make sure that the **Sharpening** setting in **Advanced Raw** (**Base Adjustments**) is set to **None** or that the **Base Adjustments** tool is turned off.

This is also a good time to introduce another Capture NX function (available on many tools):

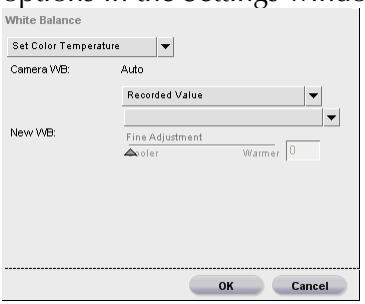


The **Opacity** option is checked, and on the **Settings** window that opens for it (note the ◂ icon) we get a host of things we can control. For sharpening, you generally only

want to apply it to the Luminance channel, so you could do that by setting the controls like this:



- *Adjust white balance for NEF images* [155]. Just as with many things in Capture NX, you've got multiple ways of doing the same thing. The "old" method of changing white balance is to open **Base Adjustments**, if necessary, and look for the **White Balance** tool (it's in **Camera Adjustments**. You'll get the traditional Capture 4.x options in the Settings window:



But if you turn on **Base Adjustments**, Capture NX will operate a bit slower. That appears to be because there are two rendering engines that must be called: first, the old Capture engine is used for the **Base Adjustments**, then the Capture NX rendering is done on the remaining steps. Thus, you might prefer to check color casts by using a **Neutral Control Point**. If you use the old method, in the

[155] Yes, Capture can work on JPEG and TIFF images. Some tools won't be available because they require the raw data to work, however.

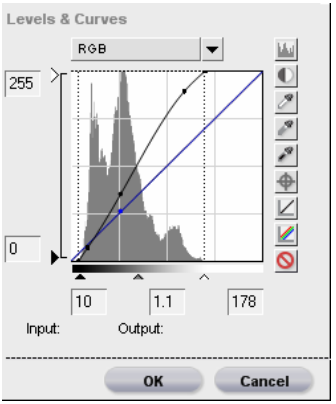
pop-up menu, select **Set Color Temperature** if you want to use the named, arbitrary values (same as in the camera plus an option named **Calculate Automatically**), or select **Set Gray Point** if you want to click in the image on a neutral area and have color casts removed.

Note: Despite all the tools and options, Capture NX is not yet a full-featured image editing program. It has an excellent set of tools that allow you to make most of the changes to how the raw sensor data is processed into an image, but it is not a complete substitute for a full-featured product, such as Adobe Photoshop CS2. Personally, I use Capture NX only for its unique tools (camera control, interpolation of NEF images, and post-image manipulation of exposure and white balance on NEF images), and use Photoshop CS2 for almost everything else.

Note: Changes you make aren't permanent if you save your work. If you save as a .NEF file, Capture NX saves the tool settings, steps, and other data of what you've done, but it doesn't actually change the original raw data. If you save your work as a TIFF or JPEG, obviously the effects of your changes are permanently embedded in the image data that's saved, though.

Other Tools

Since many of the help file messages in Capture NX are essentially "the widget tool allows you to control the widget," I'm going to step through a few of the tools and try to put a bit more meat on the table than Nikon did.

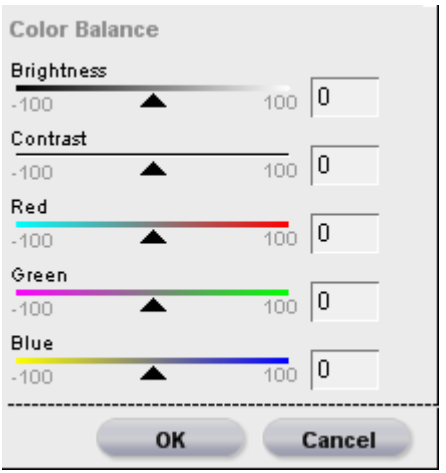


First up is the **Levels & Curves** tool. We have four primary things we set with this tool (plus we can do the same for individual channels):

- *Black point.* The black triangle on the bottom of this control allows you to set what will be "black" in the output. If you had used the full exposure range of the camera, it would normally be 0, but as you can see on this example, there wasn't much scene contrast, so I can pull the black level all the way up to 10. Normally you'll pull the black level up to the bottom point of your histogram data. You can also use the black dropper icon on the right to set the point by sampling from the image.
- *White point.* Like the black point, but now we're working the right hand (white triangle). Normally you'll pull this down to just above the top of your histogram data. You can also use the white dropper icon on the right to set the point by sampling from the image.
- *Gamma.* The middle gray triangle is the gamma point, which controls the definition of what middle gray is. You don't move this control as often as the others, but sometimes you'll enter a value slightly larger than 1.0 to boost midrange values on dark images (as I've done here). You can also use the gamma dropper icon to set the mid-point by sampling from the image.
- *The "Curve."* The straight line that goes from the black point up to the top of the graph above the white point

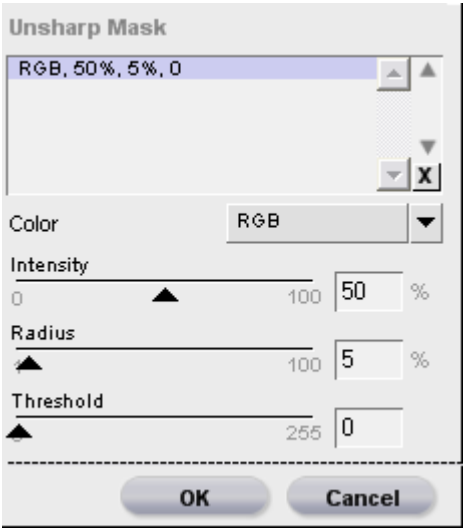
doesn't have to be straight (always shown in blue as the reference "curve"). You can click on any point on the line and then use the arrow keys on your keyboard to move that point up or down. What you're changing is the relationship between input value and output value. By default, an increase of 1 in the input value is an increase of 1 in the output value. When you start changing any of the options in this control, you break that relationship and create a new one. In general, many D80 images look a bit "better" with a very slight upwards curve in the upper highlights.

There are more controls and many more nuances in the **Levels & Curves** control than is fitting to describe in detail on a book about the D80. If you're doing more than I've just described, you're considerably deeper into image processing than we've got room for in this already long tome.



Next on our list is the **Color Balance** control (**Adjust/Color** menu). The temptation for novices is to use this control for image corrections because it seems simple (brightness, contrast, red, green, blue) and sort of mimics what they're used to on their televisions. My word of advice: don't use it. These adjustments are crude, and there are better ways to do every one of them. Brightness and contrast are better

controlled with **Curves**, and the colors are better handled by using control points.



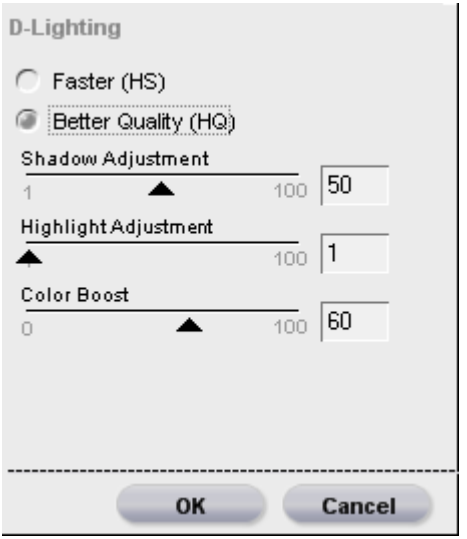
The **Unsharp Mask** is next up (**Adjust/Focus** menu). Capture NX uses different values and definitions for this tool than does the Adobe Photoshop **Unsharp Mask** filter (this is true for a few other image editing programs, as well). Here's how the two compare:

Nikon Name	*Nikon Range*	*Adobe Name*	*Adobe Range*
Intensity	0-100%	**Amount**	0-500%
Halo Width	0-100%	**Radius**	0-20 pixels
Threshold	0-255	**Threshold**	0-255

Example: A setting of 20%, 5%, and 0 in Nikon Capture is approximately the same as a setting of 100%, 1 pixel, and 0 in Photoshop. (If you don't remember what each item does, go back and re-read the section on Sharpening earlier in the eBook [see "Sharpening" on page <332>]).

I'm not a big fan of Capture's sharpening, though it's grown on me over time as I've learned to use it more subtly. It definitely has a slightly different "texture" to the effect than does Photoshop's similar tool. As you'll discover in "Other

Manipulation Tools," I suggest that you get a dedicated sharpening tool, as you'll get more control over the process.

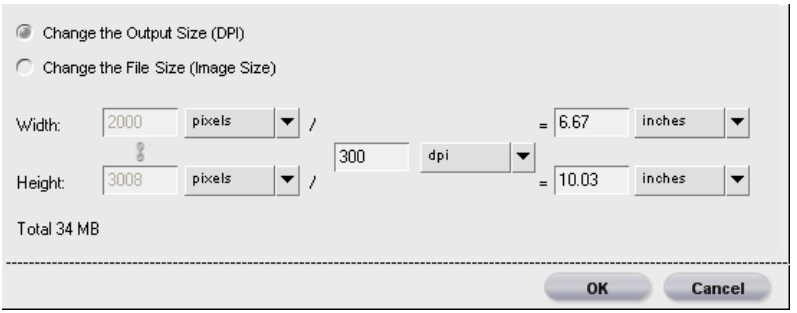


The **D-Lighting** tool (**Adjust/Light** menu) is the replacement for DEE in previous versions of Capture (Dynamic Exposure Extender). **D-Lighting** is a second way of altering exposures in Capture NX (**Curves** was the first; there will be more). In a way, **D-Lighting** is a method of building a curve that deals with just the shadow area, just the highlight area, or both. (Note that you have to click the **Better Quality** radio button to see all the controls in this tool.)

This control is cruder than Photoshop's **Shadow/Highlight** adjustment, but still effective. Usually you'll set the **Highlight Adjustment** to 0 and then try dragging the **Shadow Adjustment** control. Moreover, I find that you can really only effectively use this control for shadows or highlights, not both simultaneously (if that's what you need to do, use Photoshop's controls).

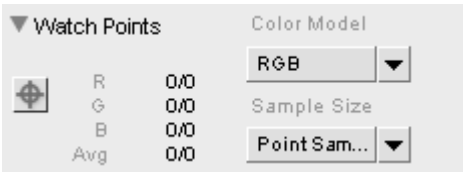
Without D-Lighting *With D-Lighting*

Note: It pays to have the **Photo Info** *tool open and visible when you're playing with* **D-Lighting**, *as the histogram will be updated and provide you additional feedback.*

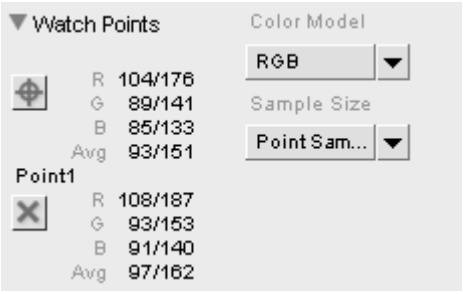


Capture NX does an excellent job of resizing images, if you need that. Indeed, some people think that it does a slightly better job than Photoshop's bicubic resampling. First, enter the dots per inch for your printer (most inkjet users should enter 288); note that before you enter the dots per inch, you may need to change the width and height units to something other than pixels. Then enter a new value for **Width** or **Height**.

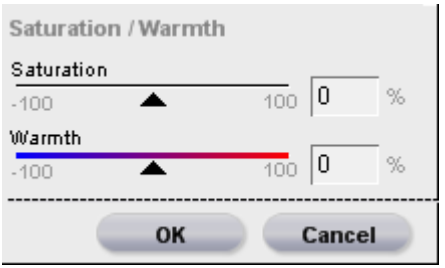
Note: To cancel or change a resizing, turn it off in the **Edit List** *steps!*



Watch Points (**Photo Info** window) tells you the position and value of the pixel at the current cursor position on the main image. That's useful, but there's an even more useful ability: if you want to compare two (or more) points, click on the crosshair icon, click on a point in the image, and now as you move elsewhere in the image you'll be able to see how the values differ:



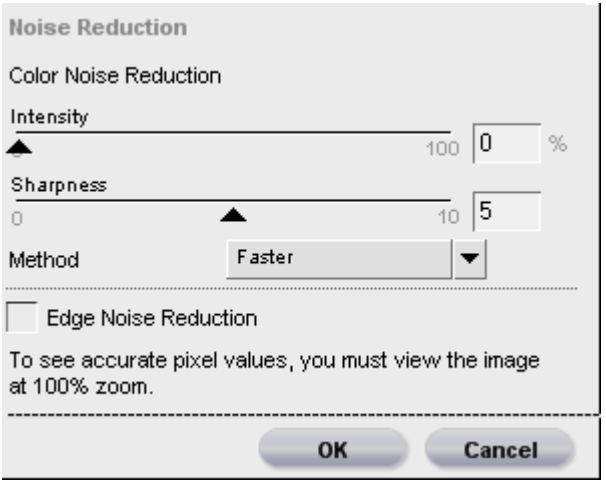
A little crosshair icon is placed along with a matching number on the image so you can remember which point is which (right-hand image, above).



Saturation / Warmth allows you to change the intensity of the color (saturation) and the overall color cast (warmth). This is a simple slider control that should be self explanatory.

Photo Effects (on the **Filter** menu) is a carry-over tool from Capture 4.x. Like a number of Capture's tools, it's actually quite versatile, but not well explained or self explanatory. First, **Method** allows you to change the image to monochrome. The thing that throws some folk is that **Tinted** doesn't seem to tint the image (hint: you have to then use the color sliders at the bottom of that tool). The top slider is **Brightness**, the bottom three sliders are the equivalent to Photoshop's **Color Saturation** tool and adjust the complimentary color spectrums (Cyan/Red, Magenta/Green, and Yellow/Blue). Note that you can use these color sliders even if you don't choose an effect.

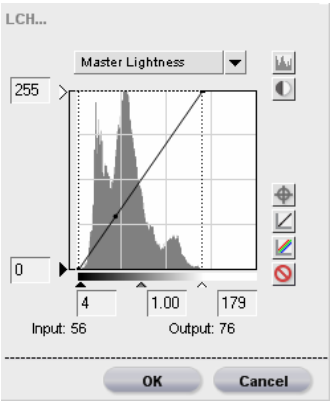
Egad, we've now got even more dueling brightness and color controls! It's *very* easy to get multiple tools turned on that make similar (or even the same) adjustment to an image, which can make it tough to make subtle adjustments. While I'm going over these other controls, their primary reason for existing is to maintain compatibility with images edited with previous versions of Capture. Control points are the most useful tool in Capture NX, and the one you'll use most often (which is why I explained them in detail first).



Two controls live in the **Noise Reduction** tool (**Adjust** menu), and they all do different things:

- *Color Noise Reduction*: this function is used to reduce the colored patterns noise takes on when you use high ISO values. The D80 doesn't really produce much chroma noise at lower ISO values, and I find this tool useful only at ISO 1600 and above.
- *Edge Noise Reduction:* this function tries to remove noise from distinct edges, which, theoretically, makes those edges more distinct.

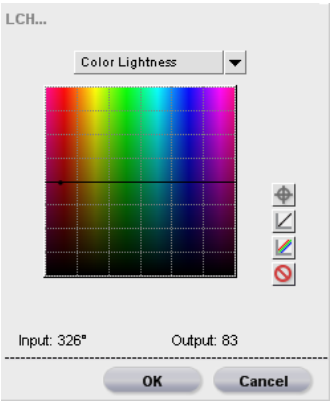
But I'd generally say avoid Capture's **Noise Reduction** tools if you can. The programs I mention in "Other Manipulation Tools" (see page <689>) do a better job, in my opinion.

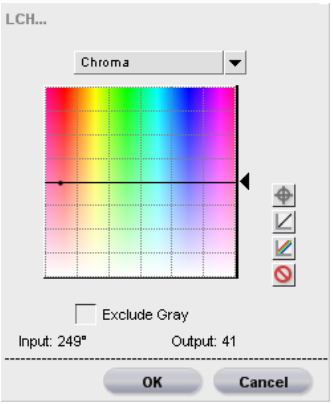


Our last tool I'm going to cover is a four-parter: the **LCH** tool (Lightness, Chroma, Hue) [156]. This tool comes to Capture from the Nikon Scan software, where it has been available since version 3 (thus, it's not a new tool just coded, but a mature one).

You'll note that the **Master Lightness** portion of the tool looks exactly like the **Levels & Curves** tool. Yep, it works the same way, so you already know how to use it. Whereas **Levels & Curves** works with RGB data, **LCH** works with Luminance and Color data (sort of the CIE Color Lab mode, only expressed a bit differently, as we have no A and B channels). Normally, you're only going to pick one or the other to use (**Levels & Curves** or **LCH**), not both, as they interact, and you can get lost in the sub effects they have on each other.

[156]Yes, I know I said four parts. The lightness control now comes in two forms: **Overall Lightness** and **Color Lightness**. I guess no one at Nikon wanted to rename it the LLCH tool.

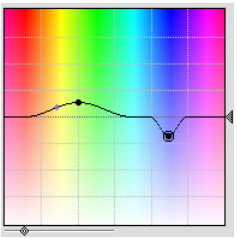




If the first part of the tool looked familiar, we're now on unfamiliar ground when we pick **Color Lightness** or **Chroma**. These options have a very interesting (and unusual) implementation. The vertical axis is brightness or saturation. If you wanted to saturate or desaturate the color for everything a bit, you'd move the black line up or down with the ◂ handle on the side of **Chroma** tool. Nice.

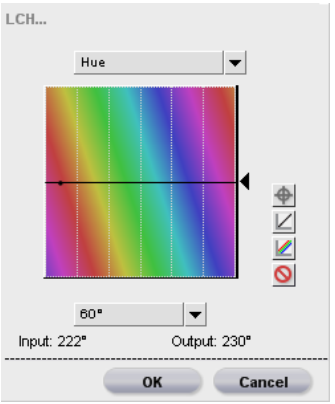
But even nicer is that you can click on the line at any point and drag that point up or down, essentially changing the color at that point. Try it. Choose one of the two options with a picture that has some points of specific color in it, find that color's position on the line and then drag a point up or down. When you do this, a slider that controls the width of the curve

pops up under the color chart. Want to increase green and yellow saturation but pull down blue? Try something like this:



Wondering how you might use **Color Lightness**? Well, pick an image with a blue sky and pull the blue point downwards (darker). Instant polarizer!

If that isn't crazy enough, the **Hue** option works the same way, only you have to think at an angle:



If you drag up from where yellow intersects the line, you're moving yellow towards green; if you drag downward you're moving yellow towards red. Click on the little number under the color chart to change the angle of interaction between the colors (i.e. how fast the change from one color to another is made).

The **LCH** tool is wickedly crazy, but very fun and useful. Unlike the general **Hue** control where you're changing all the colors in relation to one another on the color wheel (you can

do that here by moving the line up and down), the **Hue** portion of **LCH** allows you to affect *individual* colors. This is a control that has to be played with to see its impact, so I suggest you do just that on some of your images. Where I find it most useful is in dealing with slight color tints that occur because of multiple color temperature sources, but I'm sure you'll find your own use.

I've really only touched the surface of the Capture NX tools. While Capture NX has always had some interesting abilities, this latest version has added some very unique and useful tools (like the control points) while keeping the rich tools of the previous version of Capture (like the **LCH** tool I just covered).

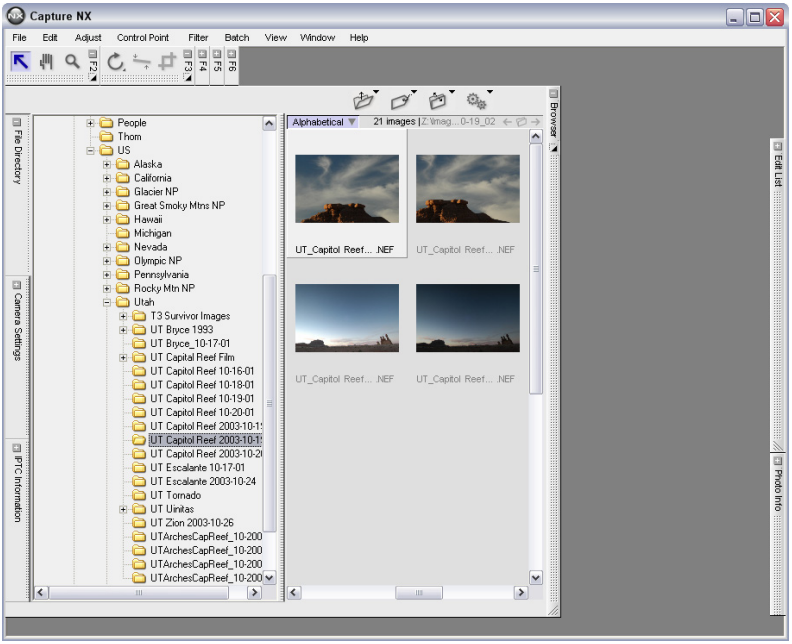
Overall, I find that Capture NX rewards those that spend the time to learn all its nooks and crannies and, yes, idiosyncrasies, with a deep set of tools that help you make transforming results with very little work. Don't believe me? Well, let's use Capture NX to do just that.

One Image Processed by Capture NX

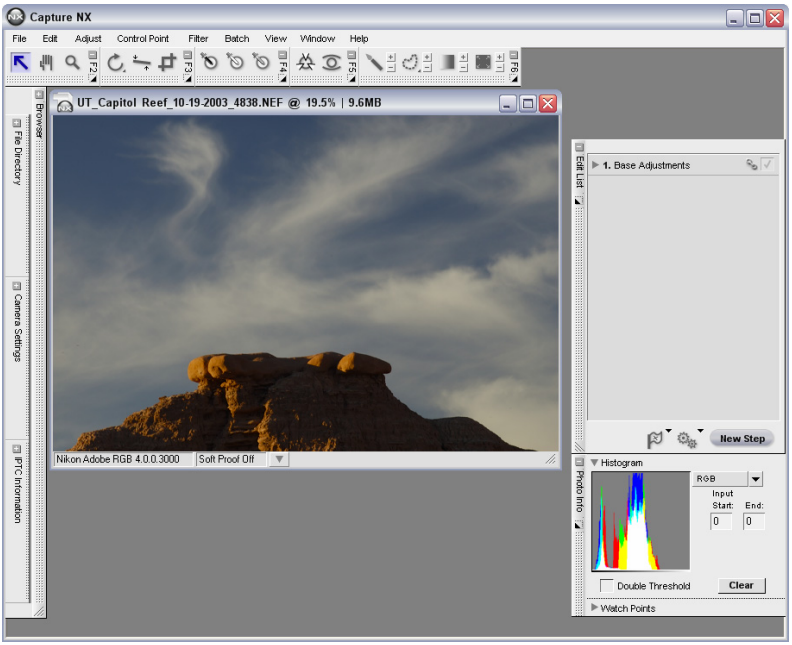
I'm going to try to put together what I've written so far about the Capture NX tools by walking through a typical NEF image. I'm going to pick an image that is not quite right as shot so that I can show off how using just a few of Capture's tools can make short work of an otherwise tough image[157].

First, I'll start with the **File Directory** and **Browser** tools to navigate to my chosen image. I start by using the **File Directory** structure to find the appropriate folder, then use the **Browser** window to find the image:

[157]This kind of step-by-step process is something I try to do in every issue of Nikon DSLR Report (albeit in even more detail), usually with the cover image. So if you find this section useful and interesting, you might want to subscribe. See http://www.bythom.com/d1report.htm for details.

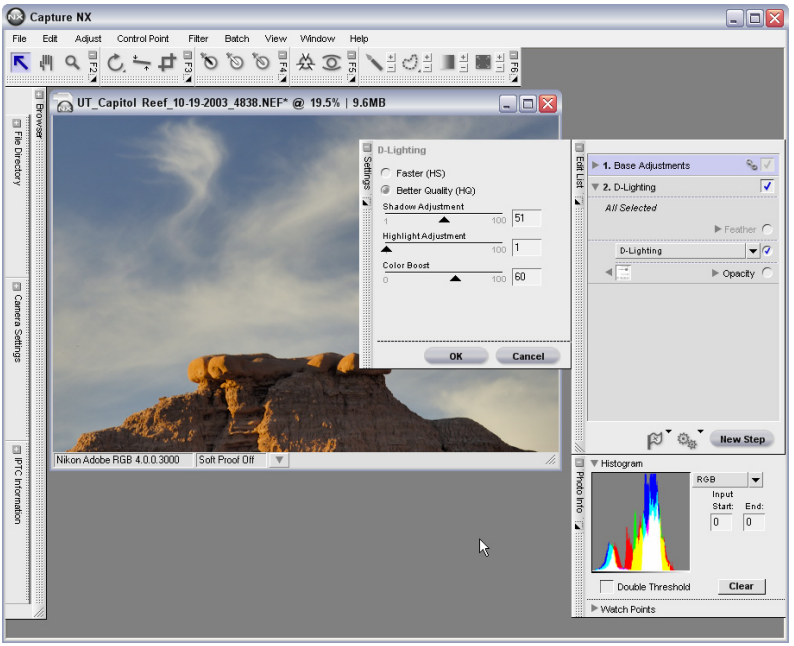


Let's see how the selected image looks in Capture NX:



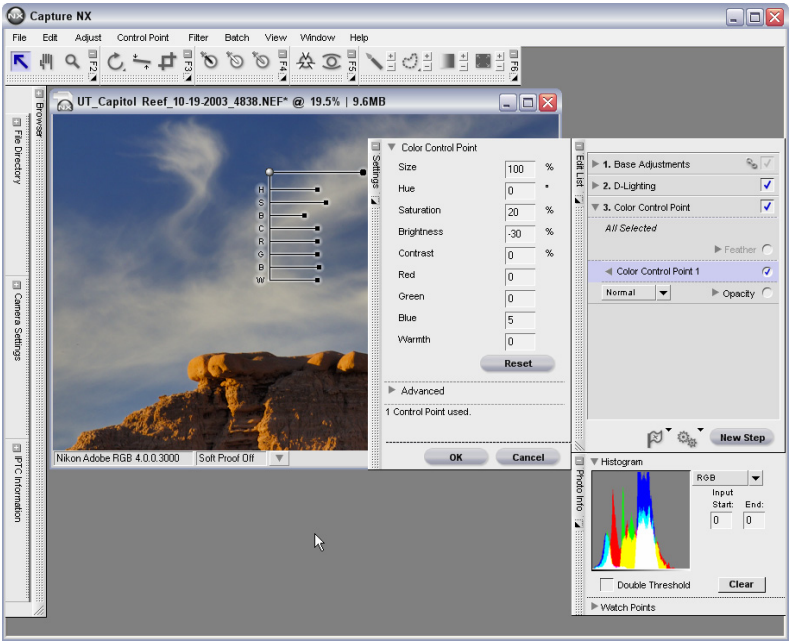
Eek! What a mess. The image is underexposed and looks quite drab. Detail is lost in the hoodoo (rock), and the sky just doesn't look like a correct sky color.

First up, let's work on the shadow detail by using the **D-Lighting** tool (On the **Light** sub-menu of the **Adjust** menu):



My sole goal here is to restore the detail in the rock. Note that the histogram has changed, though it is still not perfect (I could set white and black points with either the control points or **Levels & Curves**, but we'll wait to see if we need to).

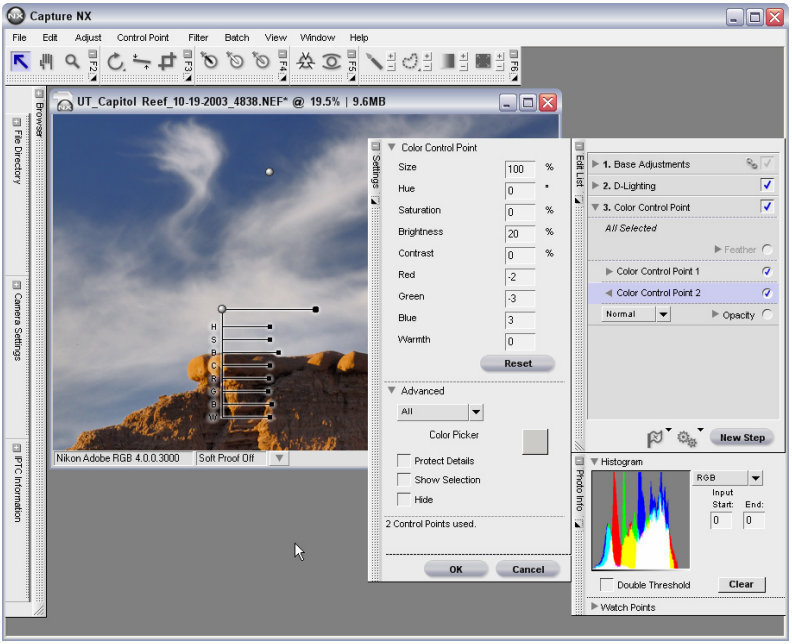
Next, I'm going to set a couple of control points. First, let's deal with the blue sky:



I've used a control point to goose the blue up quite a bit (lowering brightness and increasing the blue channel output and saturation so that the changes will be obvious. Depending upon the device I output this image to, I might choose to be more subtle or more dramatic (some printers aren't good at rendering blues and you have to over exaggerate a bit). For the purposes of this tutorial, just note that I'm tending towards more dramatic changes than I actually make with my images [158].

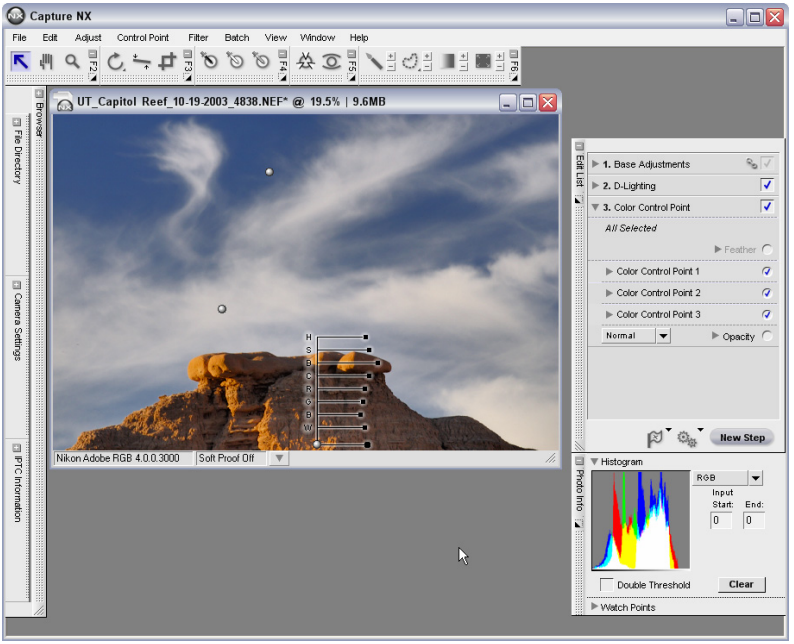
The clouds in the sky weren't really changed much by my previous control point, so I'll pick another for them and get their color and density under control:

[158] Part of the reason is that I don't know what kind of monitor you're using. On a good, perfectly calibrated monitor even small differences should be visible, but I can't assume everyone reading this has that.



The clouds should look "whiter" at this point—I've tried to remove the slight color cast in them. I've also lifted their brightness a bit (note the histogram is now looking better).

My final control point will be on the rock, as I want to work on its color and brightness a bit.

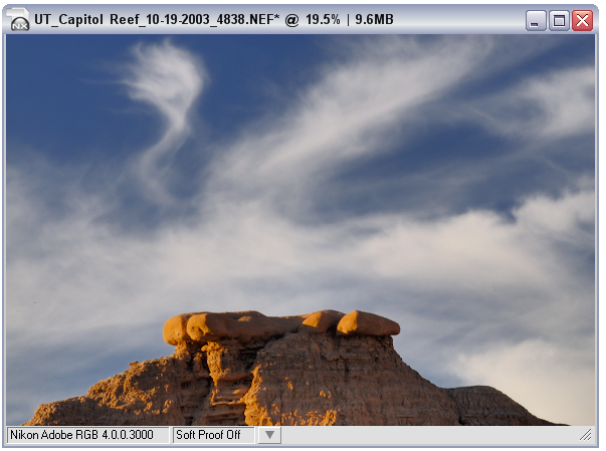


Overall, I've worked at giving the image "punch" and getting the colors corrected to what I saw them as. If you're looking closely, you might note that the clouds in the lower right corner still have a bit of color to them. That's because my second control point didn't extend fully into that area. I'd probably go back and make that adjustment, but for this tutorial, we'll just stop here.

Note that I've made pretty dramatic changes to the image in just four quick steps. Don't believe me? Here's the before and after:

Before:

After:

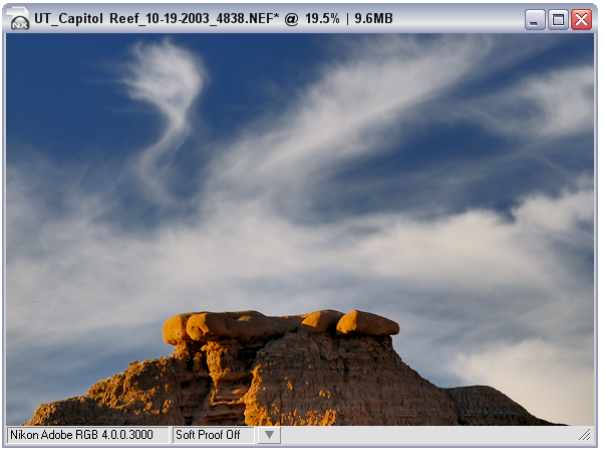


There's still plenty of work that can be done on the image. In Photoshop I'd be cleaning up a couple of small dust spots in the sky. I'd also like to see if I could give the suggestion of more detail in the clouds, which means working in smaller steps with multiple cloud and sky control points. The sunlit edges of the rock are a little too bright for me; I'd like to pull them back just a bit.

Finally, there's one other thing you should do: soft-proof your image (display it as it is likely to print with your chosen printer and paper profiles). I've actually made changes in this

image that should intentionally show a real difference when I elect to soft-proof it:

Off:



On:

Look what happened to my blue sky when I turned Soft Proofing on with the profile for the paper I normally use! It has changed color. You may also be able to see that the most light-saturated red rock is going a little orange. How do I fix these things? Well, that's one of the joys of control points and the Capture NX "step system": just go back to the appropriate step and change the settings. In this case, I've done so much manipulation on the sky that I've taken the blues out of the gamut that my printer can produce on my chosen paper.

Note: Back in the "Digital Workflow" section you may have noted my separate folders for Web and Print output. Now you might have another idea why it's necessary to create two different outputs. Besides the fact that my output size would be different for the two, so might my conversion and color adjustments.

I certainly don't hold this out to be any great image—I simply picked an image in my files that had problems in it for which I could run various tools in Capture NX to help. The primary thing I want to show is what you see directly above: a small bit of tinkering in Capture NX can often restore things that you thought were beyond saving. If you go back to the first screen shot of the Browser window, you can see that I had another image that had the same poor look. I could now save the settings I made to this image and then apply them against the other image and get similar results. I might have to move the location of my control points, but I wouldn't likely have to do much else.

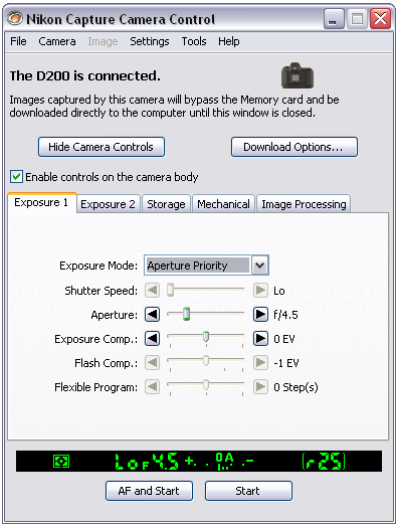
The bottom line is this: Capture NX has a user interface that's unfamiliar and a lot of depth to its tools. Those two things tend to make some who try the software quickly abandon it. Yes, the initial learning curve is relatively high, but the eventual payback is also very high.

Nikon Camera Control Pro

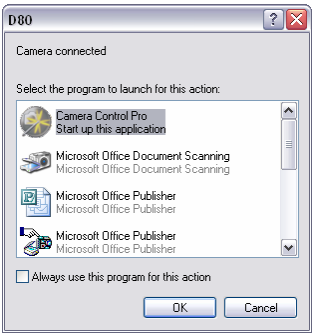
In conjunction with rewriting Capture, Nikon took the camera control features out of Capture and released a new product, called Nikon Camera Control Pro. This new software program allows you to do two basic things: shoot with the camera tethered to a computer, and change settings on the camera from a computer.

Controlling the Camera

Once Nikon Camera Control Pro is running with a camera connected to the computer, you'll see a display that looks like this:



If you connect a properly configured D80 to a Windows machine upon which Nikon Camera Control Pro is installed, you'll normally see the Autorun dialog:



Choose **Camera Control Pro** and click the **OK** button.

If you see a window like this:

Then your camera either isn't turned On, it isn't connected to the USB port on your computer, you haven't set **USB** to **PTP**, or the camera driver wasn't installed properly on your computer.

Things to note in the window that appears:

- The top line tells you that your camera is correctly connected.
- The camera control area in the middle is a tabbed dialog; some camera settings are accessed on specific tabs.
- The black bar with green indicators is a representation of what you'd see at the bottom of the camera viewfinder.
- The buttons at the bottom of the window are the equivalent to the shutter release.

The camera will also have PC displayed in its top LCD where the frame counter normally is.

At this point, you can make camera settings or take a picture.

Taking Pictures with Camera Control Pro

Taking pictures works one of two ways:

- *Control the settings and press the shutter release on the camera*. The image is automatically transferred to the computer if Nikon Camera Control Pro is active and the computer and camera are connected properly. No image is stored on the Secure Digital card. (Make sure to save the image on the computer where you can find it!) You control the transfer situation by clicking on the **Download Options** button.

Note: The **Enable controls on the camera body** *option on the* **Camera** *menu must be checked for this to work.*

- *Use Nikon Capture Camera Control to set the camera options* and *virtually press the shutter release*. Again, the image is automatically transferred to the computer and no data is stored on the Secure Digital card in the camera. While most camera controls are available remotely on the

computer, the Power switch, Focus Mode Selector lever, the Mode dial, and Depth of Field Preview button can only be manipulated directly on the camera. Other limitations you need to be aware of:

- You can't use the self-timer.
- You can't autofocus without the D80 taking a picture.

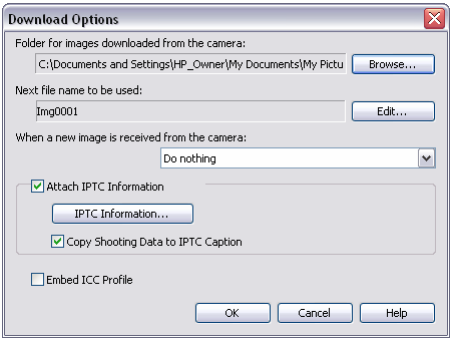
Not all error messages that may appear in the D80 viewfinder and color LCD are duplicated in Nikon Capture's simulated LCD panel and viewfinder information display. For example, the flash-ready light does not appear after exposure when the flash fires at full strength.

- *Use a combination of camera and computer control and release.* Make settings on the computer and press the camera's shutter release, or make settings on the camera and click the shooting buttons on the computer.

Note: The **Enable controls on the camera body** *option on the* **Camera** *menu must be checked for this to work.*

Note: If the default settings are used, the D80 operates for 15 minutes before it goes into a standby mode. Note, however, that when the camera goes inactive when connected to Nikon Camera Control Pro, it cannot be reactivated from the PC; you must press a camera control to wake up the D80.

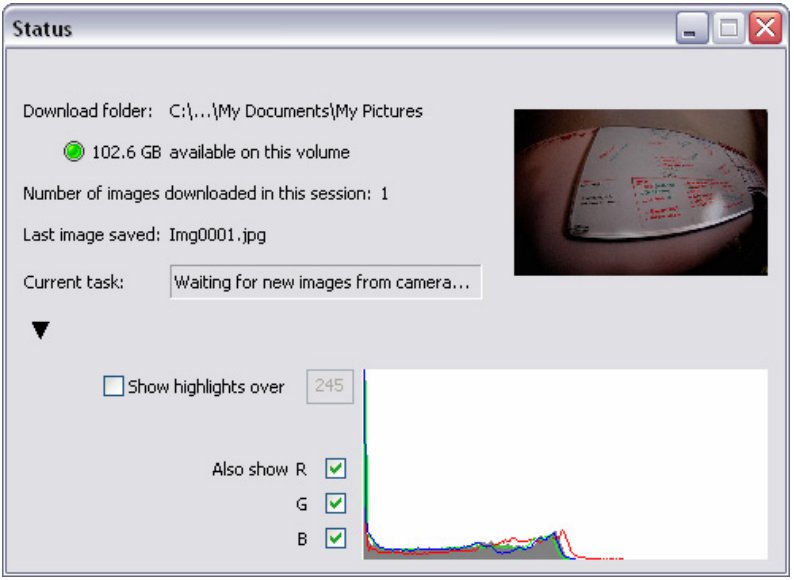
Where do pictures go that you've taken with Camera Control Pro? Good question! You need to tell it where you want them and how you want them handled. To do this, select **Download Options** from the **Tools** menu:



Generally, I always take advantage of the IPTC capability to make sure my captioning and Copyright information is attached to the file.

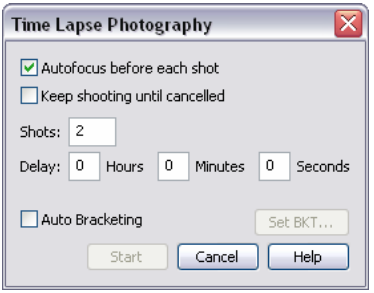
When you take a picture with your D80 connected to your computer through Nikon Camera Control Pro, you'll get a status box as you take each image:

If you click on the ▶ icon in the lower left, you'll also get a histogram display:



You can see and batch process images taken this way, though: select **Show Viewer** on the **Tools** menu to bring up a primitive viewing tool. Better yet, select **Show Capture NX** on the **Tools** menu and make sure that the Capture NX batch processing has a **Watched Folder** set the same as your **Download Options** folder. This is all a little clunky and cumbersome compared to a fully integrated program, but I suspect it will get better in subsequent versions of both programs.

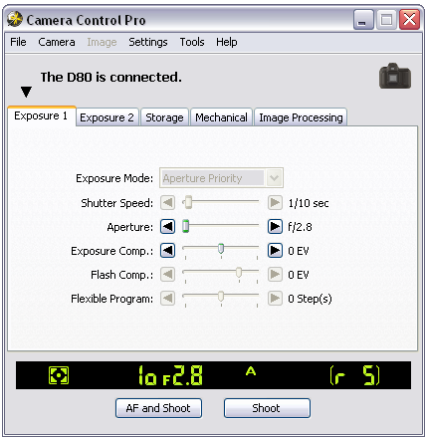
One interesting aspect of picture taking that Camera Control Pro enables is a form of time lapse photography (the D200 and D2 series also have this capability built into their menu systems, but the D80 does not). Select **Time Lapse Photography** from the **Camera** menu. This brings up a dialog that allows you to set the controls necessary for this style of photography:



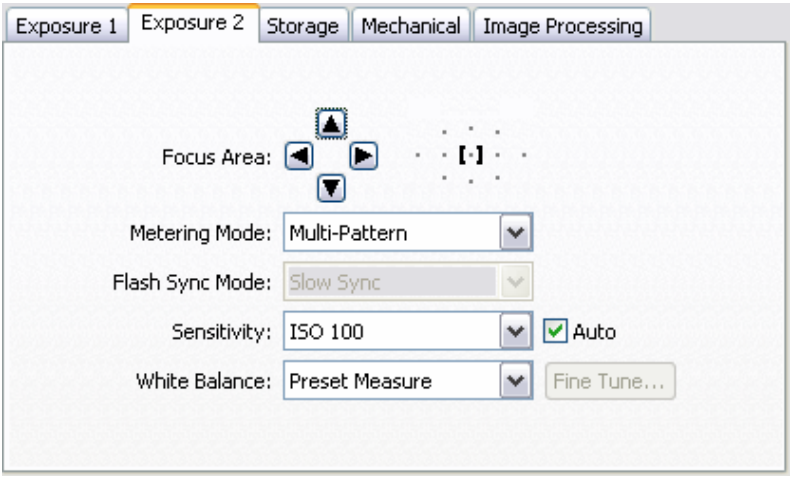
Note: Camera Control Pro's **Time Lapse Photography** *function is limited to 9999 shots.*

Making Settings with Camera Control Pro

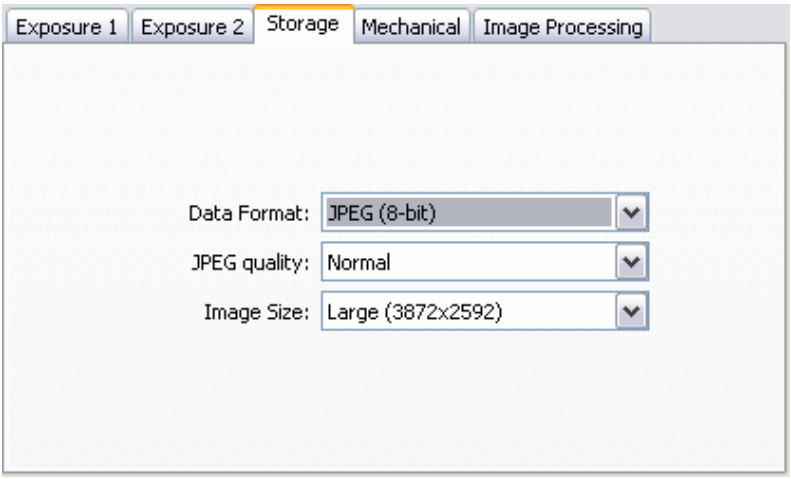
As already noted, you can make camera settings with Camera Control Pro. Let's step through the primary screens and make a few comments as we go:



For shooting, our camera settings are all made with the tabbed section in the middle of the window. The first tab—**Exposure 1**—allows the basic settings that impact our image's exposure.

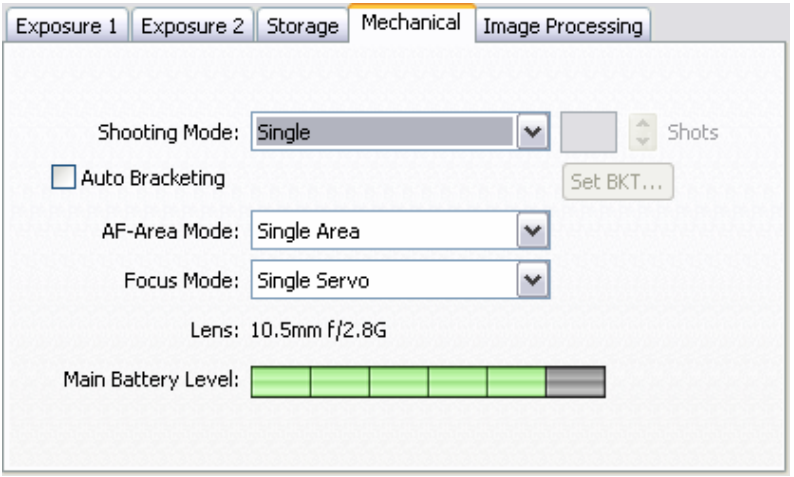


The second tab has a virtual Direction pad at the top to control the AF sensor area (click the arrow buttons). The actively chosen sensor (or group of sensors as in the example shown) is shown to the right of the virtual Direction pad. This screen also does an interesting thing and throws in one of the Custom Settings, **Auto ISO** (and yes, this does interact with the **Custom Settings** dialog that we'll get to later).

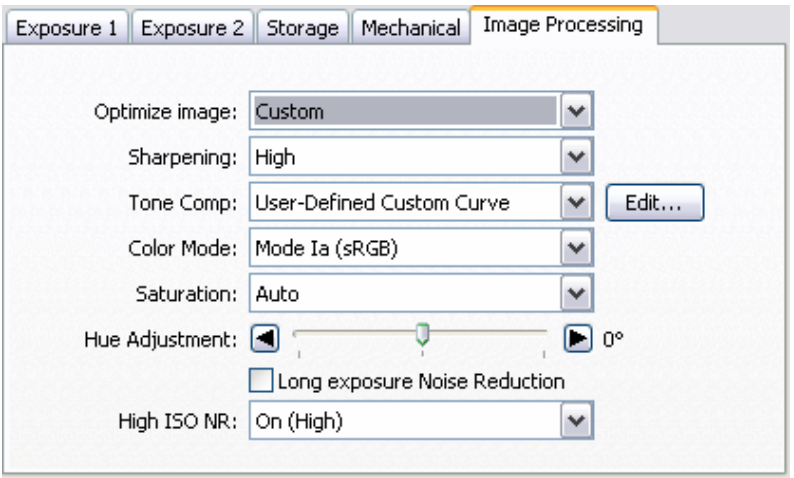


The **Storage** tab is a bit misnamed (you don't actually specify where the images are stored here—that's done on the

Download Options item on the **Tools** menu). It really should be named *Quality/Size* or perhaps *Image Quality*.



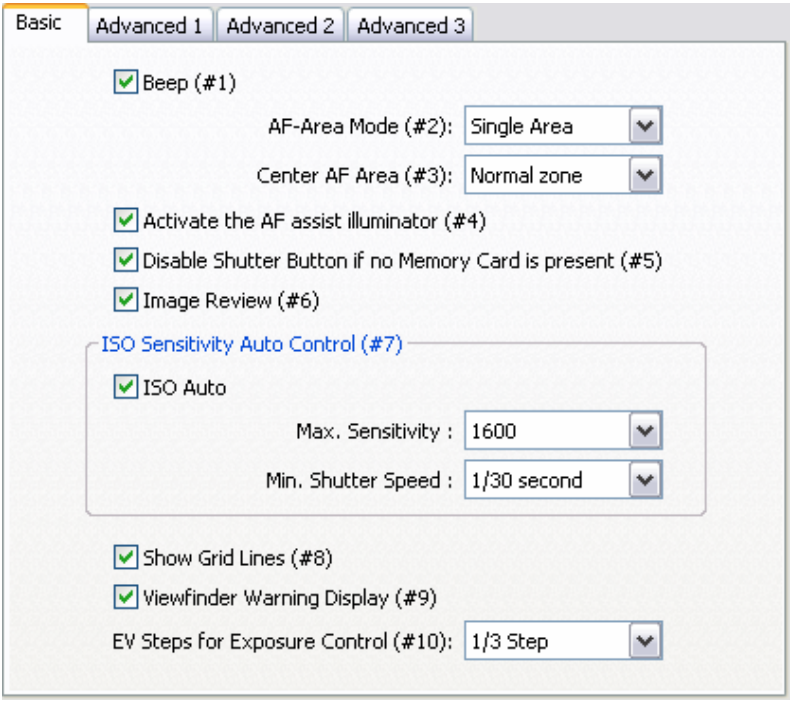
The **Mechanical** tab let's you set the remaining AF and shooting options. Note the battery level monitor!



The final tab contains the settings on the SHOOTING menu that impact the image look, plus the addition of **High ISO NR** and **Long exposure Noise Reduction**, as well as the option of being able to edit any **User-Defined Custom Curve** tone

compensation value you set (see “Custom Curves” on page <519>).

We’re not done yet, though. Select **Custom Settings** from the **Camera** menu and we get yet another dialog (instead of using tabs to navigate, it uses a pop-up menu to move between the groups of custom settings):



Custom Settings are rather involved on a D80, and so is the interface. You have to pick one of the four groups of settings via tabs (**Basic** and **Advanced 1** through **Advanced 3**).

Some users may find these dialogs easier to use to set the camera than the scrolling Custom Settings menus on the camera, mainly because the names are expanded and more easily deciphered.

Now comes the payoff for all these dialogs you have to navigate—you can save and load all these settings in one action:

1. Make all your settings (that's potentially 4 tabs worth of mousing and clicking).
2. Select **Save Camera Settings** from the **Settings** menu and fill out the standard **Save** dialog that appears.
3. Later, when you want to reset the camera that way, select **Load Camera Settings** from the **Settings** menu and navigate the standard **Open** dialog that appears to the file you saved in Step 2.

Note: Apparently the settings saved and loaded this way are custom to an individual camera. You can't save the settings from one camera and load them onto another. Pity.

I don't know about you, but this feature has a big payoff for me. I use my cameras in a few standard ways, but in between I'm always fiddling with settings to test things for books or to answer a reader's question about something. Yet I know that I can restore my **Thom Landscape D80** settings with a couple of clicks and have my camera set as I want it for nature photography.

Photoshop NEF Filter

Nikon supplies a NEF import filter for Photoshop with the D80. As noted earlier, it is installed when PictureProject is installed.

Note: If you have multiple versions of Photoshop on your machine (I have Photoshop 7 and Photoshop CS2, for example), you will probably find that the Nikon NEF filter got installed into the older version (the installer isn't particularly intelligent, and it doesn't look for multiple versions of Photoshop). The actual plug-in name is Nikon NEF Plugin.8Bi*, and it normally lives in the* Plug-Ins/Adobe Photoshop Only/File Formats *folder within your Photoshop program folder. You can copy it to other Photoshop installations, if necessary. In*

Photoshop CS2 you'll get a message about the Nikon NEF filter:

While the Nikon plug-in is useful for work that needs to be performed quickly and with (mostly) the default settings, it isn't a very good answer for serious NEF users. That's because many of the things that Capture NX does so well—such as allowing you to fine tune white balance, for example—the NEF filter doesn't (it only allows rotation, gross white balance changes, and exposure compensation changes). For most settings, the plug-in simply looks at the EXIF header information to see what the camera settings were and uses them to interpret the data when it opens the file.

If you use Nikon's Photoshop NEF filter for conversions, pay particular attention to your camera settings, most notably White Balance, Sharpening, Tone Compensation, and Hue Adjustment. You should probably set the latter three to **Off** or **Normal**.

Note: NEF images brought into recent versions of Photoshop (5.0 and later) are 16-bit RGB images [159]. Unfortunately, that has a couple of consequences. First, you need a lot more memory to deal with an image (2x, or 35MBs). Also, in versions previous to Photoshop CS, not many Photoshop tools work with 16-bit images. Nevertheless, perform as many adjustments as possible while your image is in the 16-bit format before selecting **8 Bits/Channel** *in Photoshop.*

If you install PictureProject, you're going to find that the Nikon plug-in installs and becomes the one that Photoshop uses to open NEF images instead of Photoshop's native raw converter. If you want to use Photoshop's converter [160] instead of Nikon's, you have two choices:

- *Choose the converter to use in the popup in the Photoshop* **Open** *dialog (Photoshop CS and earlier), or the* **Open As** *dialog in Photoshop CS2*. You want to select the **Camera Raw** option.
- *Remove the Nikon plug-ins*. Remove the plug-ins with Nikon in their name that live in the **Photoshop CS/Plug-Ins/Adobe Photoshop Only/File Formats** folder.

The first option allows you to use either plug-in, the second will make Adobe's converter the only one used from within Photoshop. If you have Capture, the second option is probably the wisest (you can always open an image in Capture and have it passed to Photoshop if you want to use Nikon's conversion).

One last thing to note: you really need Photoshop CS2 if you want to use Adobe's Camera Raw Converter. That's because you'll need to use version 3.6 of the converter, and that only works with Photoshop CS2, much to the dismay of some D80 owners ("ugh, another upgrade I have to make…"). If you

[159] 16-bit? Aren't NEF files 12-bit? Yes, they are, but 12-bit isn't a setting that most computer software allows. Thus, the 12-bit data is placed into a 16-bit container with zeroes padding out the four new, unused bits. If you're technically minded, the "packing" of the data is placed in the high order bits of the 16-bit container.

[160] As I write this, the Photoshop Camera Raw converter is at version 3.5 and *does not* support the D80. I'm told that version 3.6 is in beta and will include D80 support.

have an earlier version of Photoshop and don't want to upgrade to CS2 yet, download the DNG Converter 3.6 from Adobe's Web site and first convert your D80 NEF images to DNG files. Earlier Photoshop versions can convert DNG files.

Other Useful Software

Software for digital cameras falls into what arguably are only a few categories. Basically, to fully exploit your D80's abilities, you need computer software that:

- *Converts NEF data to a common format.* NEF is a Nikon-proprietary format and usually differs a bit from one model of Nikon camera to another. Moreover, a NEF image isn't "viewable" as is—it requires software to convert the raw sensor data into a viewable image.
- *Allows image editing.* An image editing program is our "digital darkroom," allowing us to make changes to cropping, color, contrast, and a whole host of other image attributes.
- *Other (specific) image manipulation tools.* While the generalized image editors often do very good jobs with the types of manipulations you often do, a few things are still better done by a stand-alone (or plug-in) tool: noise reduction is probably the most notable of such tools, but many of us long-term digital photographers also use dedicated tools for sharpening and moiré correction. Also in this category would be panorama software and programs that correct lens defects, such as linear distortion.
- *Catalogs or organizes images.* You'll end up with thousands of digital photos. You need a way to organize and later to conveniently find them. If it also handles archiving to CD, this is a big plus.

I could go on endlessly, as it seems like new digital photography software shows up on my desk every day. But this is a book about the D80, so I'm going to limit my choices of programs to talk about and types of software to things that have some relatively direct link back to the camera.

A word of caution: I'm writing this very early in the D80's availability, and thus there's a chance that new products have appeared that I couldn't anticipate.

NEF Converters

Nikon Capture was the original D1 NEF converter. It was followed shortly by two shareware converters, Bibble (MacBibble) and Qimage. Later, additional commercial products appeared. All of these products have undergone a number of changes over the years, because the NEF file format keeps changing with each new camera. Here's a quick rundown on what I think of the major converter programs as they relate to the D80:

- Bibble http://www.bibblelabs.com (Win/Mac). Bibble was one of the first three converters to understand Nikon NEFs back in the original D1 days, and it was the first third-party converter to support the D80 NEF. A version of Bibble is built into Extensis Portfolio (see below) to help it deal with NEF files. Bibble 4.9 is the current version as I write this, and supports the D80 (US$129.95 for the full version, US$69.95 for the lite version). Downloadable 14-day trial versions are available at the Bibble site. Bibble is written by an individual, Eric Hyman, and thus has had a slightly erratic update cycle. Current and past versions of Bibble have found a range of supporters, but I wasn't a fan of its conversions in earlier versions: they tended to be slightly oversaturated in color and shadows are blocked up a bit. The current version seems to address both those issues, so I'm once again warming to the product, especially since Eric has now added sophisticated distortion and noise correction tools. The Mac version of Bibble is one of the fastest converters for OS-X users, especially those with dual processor G5s or Intel-based Macs. Unlike many of the other converters, Bibble can manage tethered camera shooting, just like Nikon Camera Control Pro does.
- Capture One DSLR http://www.c1dslr.com (Win/Mac). Phase One has been making digital backs for medium

format cameras for years. In 2003 they introduced a version of their very mature converter product that recognizes DSLR formats. Two versions exist: Capture One Pro (US$499) and Capture One LE (US$99). Downloadable 30-day trial versions are available at the C1 site[161]. The versions differ mainly in batch workflow and very advanced capabilities—the same converter and basic abilities are in both products. On previous Nikon DSLRs, my testing of Capture One Pro has shown that it does an excellent job on tough images. The workflow, once learned, is superb and richly featured. The primary drawbacks to the program are the full price of the Pro version and the huge demands it makes on physical resources (memory, disk cache, etc.). However, if I were a working wedding photographer processing huge numbers of images every weekend, I think Capture One might be my first choice in converters.

- Capture NX http://www.nikonusa.com (Win/Mac). I've already covered Capture NX in detail, but I think a summary comment here to match the opinions I'm making on the other programs is in order. Capture NX has evolved into a relatively robust and mature program. It certainly can produce conversions that are on par with, if not better than, virtually any other program. The latest batch of features has elevated it to the level where it can serve as your only conversion program. Yes, Capture NX's user interface is a bit finicky to deal with at first, but it's simple enough to master quickly. If Capture NX has a fault, it's that the batch processing capabilities aren't as flexible and powerful as some of the competitors (Capture One Pro and Photoshop, primarily). It's also a bit slower than some others, and like Capture One, a bit of a memory hog with D80 images. Still, Capture NX remains my primary and favorite conversion program.
- Photoshop CS2 http://www.adobe.com (Win/Mac). Photoshop CS2 has a raw converter engine built into it.

[161]By the way, the demo comes with a permanent, free Photoshop moiré removal plug-in. D80 users should download the demo for that handy tool, if nothing else.

The primary thing about Photoshop is that it is arguably the top image editor program, so getting a converter built-in means that you've simplified your software stack considerably (indeed, if you select other Image Editing Tools that are Photoshop plug-ins, then you do all your work essentially in one program). Thus, most people find that Photoshop CS2 simplifies their workflow. Of course, it's an expensive program (US$695 street), and a complex one at that. That means that to fully utilize it, you really need to learn it well, which means either hitting the books or attending Photoshop workshops. As a NEF converter, I don't rank Photoshop CS2 at the top, though it has some unique attributes that make it desirable; both Capture NX and Capture One do, I think, better and more consistent jobs, especially when you hit problematic images (though Photoshop seems to do a better job with highlight detail retention than Capture NX). When I need more highlight detail I use Photoshop CS2. (Note that CS2 didn't ship with the converter version necessary to understand D80 images; you must download ACR 3.6 or later from the Adobe Web site.)

A few converters have fallen by the wayside and new ones have appeared. Probably the biggest disappointment is that Qimage no longer supports current NEF formats—it had one of the best direct-from-NEF-to-print abilities available. Perhaps another half dozen converters out there understand NEF formats, including those for the D80. That's because they're all mostly based on David Coffin's dcraw routines (including Photoshop's converter, apparently). The latest iteration of dcraw understands the D80 encrypted white balance info. That's good news and bad: good in the fact that a variety of interfaces have now been built on the same code, so you can select which you like best. It's bad news in that most of these converters aren't pushing the bar in demosaicing and the tradeoff between detail and noise reduction, mostly because they're all using the same basic routine. None of the others that I've looked at belong in the same league as the ones I've noted above, however.

As I write this, two promising newcomers have appeared: Apple's Aperture and Adobe's Lightroom. The Apple product isn't mature enough, in my opinion. It's also very resource intensive and only runs on Macs (no Windows version is available). Still, the user interface is spectacular, especially on multi-monitor or large monitor systems, and the workflow is photographer friendly now that version 1.5 allows leaving images outside the main Aperture database. Adobe's Photoshop Lightroom also has a photographer friendly workflow, but it's only available in feature incomplete developer versions at the moment. It's a promising product, but not ready for actual use.

My final recommendation with converters is easy: download the free evaluations and try them. You may prefer one program's conversion (and ease of use) over another's. If you had to buy only one, Bibble and Capture NX [162] are good, safe choices. Capture NX because Nikon knows the D80 as well as anyone, and has consistently proven that they can get top-notch NEF conversions out of their cameras; Bibble because Eric has remained committed to keeping up with changes to Nikon's file formats, including the white balance encryption, and has produced a robust product with a deep set of image correction features that make it a bargain. Photoshop CS2 is interesting to most because its overall workflow is so compelling with its built-in converter, but I personal find its conversions a little lacking. You can improve them by using Bruce Fraser's calibration routine, but even then they still don't quite do as well as I've seen from other products with my files. Capture One has other benefits, mostly centered on batch workflow, that are worth examining if you become a hard-core NEF user.

Image Editors

Photoshop is the image editor by which all other image editing programs are judged. Indeed, so much so that I'm only

[162]Capture plus Photoshop Elements is the cost conscious way to go if you can't justify the full price of Photoshop CS.

going to describe three other programs I feel warrant attention:

- GIMP http://www.gimp.org (Unix/Win/Mac). GIMP stands for GNU Image Manipulation Program. What you're going to like about the program is that it is free. Indeed, if you're the programming type, you can even get the source code. Installation on a Unix or Linux system is the typical package experience, which is to say, potentially tricky. On Windows and Mac-OS, look for the links to other sites that provide pre-packaged installers unless you're the technical sort and don't mind figuring out the way the whole thing gets put together (it requires a runtime installation). Overall, the user interface is a bit cluttered and it's difficult to organize the windows if you don't have a big monitor. Still, it's free and it does most everything Photoshop does. Performance is quite decent, though on most of the things I do image-wise, Photoshop has the edge.
- Photoshop Elements http://www.adobe.com (Win/Mac). Photoshop Elements started as an older version of Photoshop that had been "skinned[163]" to help novices navigate the myriad Photoshop editing features more easily. The original version was a hybrid that didn't manage to do the concept justice. Starting with version 2.0, the underlying engine was updated to a newer version of Photoshop and the interface tweaked to make more sense on its own (version 5.0 was recently introduced and adds a few more things from Photoshop CS). Essentially, Elements has become Photoshop without the ability to directly manipulate some deeper features. As such, it carries with it a rich set of abilities for manipulating an image, with the penalty that, for some of the more advanced techniques you'll see in Photoshop books or articles, you may bump your head against the top of Elements' restricted interface. I'm not a big fan of

[163]A term software designers sometimes use to refer to putting a new user interface on top of a known set of stable routines.

dummied-down software, partly for that reason—you don't really grow with it beyond a certain point as you do with a deep, rich tool like Photoshop CS. Still, for the basics of photo correction, Elements is as capable as anything else out there, perhaps more so. Given its US$99 cost (often deeply discounted), it's an okay choice if you're interested in seeing how much you're going to get into image manipulation.

- Picture Window Pro http://www.dl-c.com (Windows). Written by Jonathan Sachs, one of the original authors of Lotus 1-2-3, Picture Window is a mostly overlooked gem. For quite some time Jonathan's photographer-orientation has shown through (this is not a tool for graphic artists that has morphed into a digital darkroom, like Photoshop has—the Digital Light & Color tag line says it: "serious software for serious photographers"). Better still, the manual is written from a photographer's viewpoint, and both in the manual, the help, and the on-line support you'll find plenty of examples that step you through the basics. Arguably the best feature of the program is the way it deals with color correction, but the Advanced Sharpen, chromatic aberration and moiré reduction tools will win fans, as well. Personally, I think Picture Window Pro matches up very nicely against the typical D80 customer, since it has a photography-centric vocabulary and design. The current version is 4.0 (US$89.95) and a 30-day downloadable trial is available on the Web site.

Hundreds of other image editors exist (indeed, I helped design one back in 1994). But almost none rise to the levels that Photoshop CS2, while the other three I mention do. A few that do—Corel's Photo Paint 11, for example—just don't have a clear enough future to be able to recommend them. Given the fast-changing nature of digital photography, you want to learn a tool that'll be around for awhile, regardless of what camera you're using a few years down the pike.

Manipulating Levels and Curves

Most image editing programs allow you to manipulate the color and exposure information via levels, histograms, and

curves. A good tool provides a minimum of the following adjustments:

- *Combined or separate RGB controls*. You can adjust all three color channels simultaneously, or one at a time. Generally, manipulating one color channel on the entire image is risky, as you can distort color balances quite easily. On the other hand, you may want to deal with individual channels if you are working on a selection from the overall image (e.g. manipulate the blue channel of a sky).
- *Histogram of values, including individual channel histograms*. The histogram tells you important information about your exposure. A histogram that has values going off either end of the display (or significant spikes near the two edges) may have blown out details or muddy shadow areas (which can be partially dealt with using **Curves**, see below). Spikes elsewhere in a histogram usually indicate that one color value dominates a portion of the exposure, which is often okay (e.g. you took a picture of a yellow balloon). A "perfect" histogram would have no values below 5 or above 250, with most of the values spread through the middle and few large spikes. The reason why you want a lack of pixels at the two ends in the "perfect" histogram is that it makes it easier to preserve highlight and shadow detail using most print technologies (if you try to print black values of 0 on most devices, you'll put too much ink on the paper, risking other problems, as well). Remember this: 0,0,0 prints as the blackest ink your print technology can produce, while 255,255,255 is the color of your paper (i.e. *no* ink is put down). Rarely do you want either condition. (Side note: the histograms shown in Photoshop are not the same as the D80 displays during shooting. Adobe's method for calculating the histogram is different; don't be surprised to see small differences.)
- *Levels tools that deal with the histogram*. You'll normally see **Input** and **Output** values, a midpoint slider (sometimes called **Gamma**), and controls (usually eyedropper icons) that allow you to pick white, neutral

gray, and black points. Be careful with using the tools provided to control the histogram. Many of them change the underlying pixel data (you'll sometimes even see gaps in the histogram after using one of these tools, which is always a warning that you've changed pixel data). Capture NX doesn't change the underlying data—it saves the correction information and applies it against the original data as long as you stay in the NEF format.

- *Curve control*. Initially, the "curve" is usually a straight line from the lower left to the upper right of a graph (sometimes superimposed over the histogram, as in Nikon Capture NX). This line implies a linear relationship from dark to light (i.e. each step in pixel value is treated equally). Clicking on a point on that line and dragging it up or down allows you to change the relationships. The "flatter" the line between two pixel values, the less difference you'll see on your screen. The "steeper" the line between two pixel values, the more difference you'll see. Typically, you don't move the curve lines very much, if at all. If you have muddy shadows, for instance, you might grab the curve line at the ¼ point and drag it upwards a bit. Likewise, to pull out detail in a very bright area (such as snow or a bird's feathers), you might drag the line down at the ¾ point. The nice thing about using curves to control colors and exposure balance is that the underlying data in the image *is not changed*[164]. If you were to later reapply the linear curve to the image, you'd have the original look back.

My final recommendation with image editors is this: download the Picture Window Pro and Photoshop Elements trials and check them out. If you're the technical type and don't mind a fussy installation, download and try GIMP. But if you're a cut-to-the-chase kind of person, bite the bullet and purchase Photoshop along with Deke McClelland's Photoshop One-on-One book.

[164]Technically, you need to do this on an Adjustment Layer for this to be true of Photoshop CS2. True for Capture with NEF files, however.

Catalog Programs

Because digital images pile up fast (they're free!), you'll need some way to organize them and something that'll let you find them quickly later.

I'll be upfront with you: I've now got over a terabyte of images on my network and I *don't* use a cataloging program most of the time (when I do, it's Extensis Portfolio, because it supports NEFs so well, though I've been experimenting with Apple Aperture). You'll remember back when I first introduced the concept of workflow that I wrote about thinking about the structure of your folders and filenames right from the beginning. Even if you wanted to (for the love of Pete, why?), you can't drop more than 9999 digital camera files that have their original name into the same folder without having files overwrite one another. But even if you only had, say, 9998 digital photos, would you want all of them named DSC_#### and living in the same folder?

When I transfer images to my computer, I usually do it with the Transfer portion of Nikon PictureProject and have that program both rename the file and create a new, renamed folder. Eventually that folder gets moved into a very organized drive hierarchy (this is greatly simplified and just a sample):

```
INTERNATIONAL
    CHILE
        PATAGONIA
        LAKE COUNTRY
        SANTIAGO
        ATECAMA
    PERU
        CORDILLERA BLANCA
        CUSCO
        MACCHU PICCHU
UNITED STATES
    AK
        DENALI
        INLAND PASSAGE
        KENAI
```

```
CA
    NATIONAL PARKS
        YOSEMITE
        SEQUOIA
        KINGS CANYON
        JOSHUA TREE
    STATE PARKS
        ANZA-BORREGO
            ANZA2002-03
            ANZA2003-03-14
            ANZA2003-03-16
            ANZA2004-03-31
            ANZA2004-04-04
        BODIE
```

And so on [165].

Within that folder structure you'll find the folders with transferred images (I show that in **ANZA-BORREGO**, above). Thus, since most of my photo requests (and even my own lookups) are place (or trip) related, I can simply open the folder structure pretty much right to the image I'm looking for. On Macintosh OS-X, you can turn on icon preview and set the Finder to show 128x128 preview icons, which means you can usually even find your images visually using my structure. Remember, too, that if the naming method you use is meaningful, the OS search tools can find you images quickly, too.

The drawback with this system is that I pretty much have to have drive space for all my photos, so my demand for storage space grows substantially every year [166]. The plus is that every image is available essentially on demand, as fast as the server can serve it to my desktop machine.

My "select" images are all IPTC captioned and cataloged in Portfolio. Thus, if a photo editor calls and asks for a

[165] I also have similar structures for people and for products, the other types of photos I take.

[166] I currently periodically back up onto even more hard drives, which then get taken off site. Some photographers I know use DVD-R for this instead.

"mountain shot on the West coast" I can type a search query using keywords and pull up the relevant shots I consider my "A" work. This can be done both when I'm at home on my server (where I have direct access) or when I'm on the road (where I only have the catalog file—one reason why I limit it to my best work).

But you should have noted something in that last paragraph: for that to work, I have to do some extra work. Indeed, if you decide to use a cataloging program to organize your photos, you should know up front that the more effort you put into adding keywords and captioning up front, the easier it will be later on to find things in ways that you might need to (or want to) later. At a minimum, you'd need to enter IPTC keyword or category information for each card transfer.

Better still would be to enter data for each and every image individually. Fail to do one of those things for even a small portion of the images you transfer and place in your catalog, and you'll have made your cataloging program into not much more than a file browser. Which brings us back to my folder structure, doesn't it?

So, before getting to the individual programs, let me state this: spend a lot of time looking at and learning the organizing abilities of the program you select *before* you shoot too many images. Consider how you might want to find images later. Imagine the types of queries you might make of the image database (is it by date, by name, by category, by person, by trip, by what?). Armed with those things, come up with a data entry plan that you'll use for *every* card of images you'll transfer to your computer. While most of these programs all have some sort of "automatic cataloging" ability, that doesn't give you much function if all that the program has to go on is filename and EXIF data (at least it'll get date and time from that).

Put another way: use of any of these programs requires an investment of time on your part in order to get any utility back

from them. The more upfront time you spend, the less back end time you'll spend looking for something.

- ACDSee Photo Manager http://www.acdsee.com (Mac/Win) US$39.99, downloadable free trial on the site. This cataloging program was designed for consumer use and is thus a little more approachable than some of the others listed here. Now in version 9, the program has been around long enough that its user interface has become pretty straight forward and easy to learn. It does have some useful features for JPEG shooters who archive to CD-R or DVD-R, but the built-in image manipulation tools are weak. ACDSee supports slide shows, printing, and plug-ins (including image editors). ACDSystems likes to promote the PowerPack or other combos of products, which adds ACDSee Photo Editor (image editor) or FotoSlate (photo printing). Of these tools, FotoSlate can be fun and useful, letting you make photo calendars, contact sheets, and cards easily. While ACDSee is reasonably sophisticated and mature, it really is targeted at casual and consumer JPEG use, which does describe most D80 users, but certainly not all. Use the trial to find out if it's for you. But compare it to PictureProject when you do: you may find you've already got what you need if this is all you want.
- DigitalPro4 http://www.proshooters.com (Win) US$259, 30-day downloadable trial on the site. Partly designed by working professionals Moose Petersen and David Cardinal, DigitalPro centers around the workflow and cataloging functions that a working professional needs. Essentially, it's a replacement for both Nikon PictureProject plus any more sophisticated cataloging program, and it does a very decent job filling in for both. Like Nikon PictureProject, DigitalPro can handle the card-to-computer transfer with some slick renaming and re-foldering abilities, and doesn't miss a beat with NEF images (a few other cataloging programs can do the former, but don't get along well with NEFs). The current version understands D80 NEF images. The cataloging

options are a little more approachable than the Portfolio design. Since DigitalPro evolved from two Nikon DSLR users' experiences, the program has long understood NEF files. Overall, I'd say that the program caters more to a hard-working professional who sells his images than to amateurs (yes, I know there are cut-down versions of DigitalPro, but if these interest you, I think there are better options elsewhere).

- iPhoto http://www.apple.com (Mac) US$49.95 in iLife, or free with a new Mac. Like most Apple products, iPhoto is a slickly designed consumer product. It doesn't do everything, but what it does do it does well and in a way that won't take you forever to learn. It handles card-to-computer transfers well (so well, it'll pop up over Nikon PictureProject when a card is inserted or camera connected unless you change your Preferences). Versions of iPhoto prior to 4.0 were interesting, but severely limited in terms of the number of images it could handle and its overall performance. However, starting with version 4.0.1, it now handles JPEG images quite well, and may be all you need if your organizational needs are modest. The current version even understands NEFs very well, though as I write this it doesn't recognize D80 NEFs (raw image recognition is something that gets updated with the Mac OS, so you'll probably find that a future update of the OS solves this problem). It's certainly simple enough to use.
- iView MediaPro http://www.iview-multimedia.com (Mac/Windows) US$160. Free trial version available on the site. iView MediaPro is yet another browser and organizer program, though one that understands NEF format files and has a few other interesting features. The company that produces it was bought by Microsoft, so iView is now a Microsoft product. MediaPro can handle the camera download just as well as PictureProject and iPhoto *and* correctly tag the color space for incoming JPEGs. This program also supports IPTC and EXIF. International users will love the fact that MediaPro is localized in French, German, Italian, Danish, Dutch, Spanish, Portuguese, Russian, Chinese, and Japanese, as

well as English. This is a nice, relatively lean, and fast cataloger with some interesting additional abilities.

Cataloging programs change rapidly, though few really seem to have been designed with a photographer in mind. Indeed, that was one of the interesting things about iPhoto when it first appeared: it stood out from many of the others just by the fact that it was so photo-centric and seemed to only be oriented towards the things you'd want to do with a photo. Go figure.

Fortunately, things seem about to change. Both Apple's Aperture and Adobe's Lightroom finally look to be bringing the cataloging features we need into a photographer-centric workflow.

My final recommendation with cataloging programs boils down to this: if you're serious about taking digital images, organizing them, and then finding them quickly later, you really need something. But with Aperture already on the market and looking decent in the first release and Lightroom on the horizon, I think it pays to wait. If you have to use something today and shoot NEF, try Extensis Portfolio, DigitalPro or iView MediaPro. Check out the free trials and choose the one that you like best.

Other Manipulation Tools

Literally hundreds of software programs oriented towards digital photography have popped up. While we've cut the herd down to a handful of useful products already (see above), we're still left with a handful of useful products that don't fit any of the easy categories just listed. I'll try to keep this list short and concentrate on things that are specifically useful.

First up we have noise reduction software. The D80 isn't what I'd call a "noisy" camera, so your need for noise reduction software isn't as strong as it is with, say, the D2xs. Moreover, if you shoot at higher ISO values and use the in-camera noise reduction, post processing noise reduction has a tendency to lose detail and destroy edges. Still, it's worth having a noise

reduction program for those times when you have to bring down the levels of visible noise.

Windows users have it a bit better than Macintosh users as far as noise reduction goes, though this is slowly changing. The short list of primary contestants are: Dfine, Neat Image, and Noise Ninja. The first two are available as Photoshop plug-ins, which improves workflow (you can automate processes with Actions and Droplets). I'm not going to call a winner here; it's really splitting pixels to try to describe why one might be slightly better than another[167]. In practice, using any one of these is preferable to not using any. Dfine is probably the most approachable for a novice. Noise Ninja is probably the fastest. I personally use Neat Image.

- Dfine http://www.nikmultimedia.com US$99.95 (Mac/Win, Photoshop plug-in).
- Neat Image Pro http://www.neatimage.com US$59.90 (Mac/Win standalone application; Photoshop plug-in adds US$15). Note that you'll generally want the Pro version, as it deals with 16-bit files (e.g. NEFs).
- Noise Ninja http://www.picturecode.com US$39 (Mac/Win; Photoshop plug-in version available).

Another similar category is sharpening products. Here things get muddier: Photoshop, Capture NX, and virtually every other converter and image editor have Unsharp Mask filters or other similar sharpening tools. Used well and wisely, that may be all you need.

That said, there are two reasons to go with a third-party, dedicated sharpening tool: (1) the tool has a more understandable interface or one that is more dedicated to the intended use than setting individual parameters (nik Sharpener is an example of the latter); or (2) the tool takes a more refined approach to sharpening than applying edge

[167]This is the sort of in-depth analysis I'd save for the Nikon DSLR Report, where I spend a lot of time looking at and describing pixel level differences.

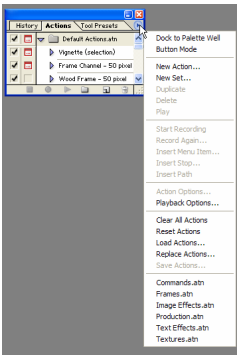
contrast adjustments to data after a mask created by Gaussian Blur is applied [168] (PhotoKit is an example of this).

- FocalBlade http://www.thepluginsite.com/products/photowiz/focalblade US$49.95 (Win, Photoshop plug-in)
- nik Sharpener Pro http://www.nikmultimedia.com US$79.95 Home edition (Mac/Win, Photoshop plug-in). Inkjet and Complete editions are also available at more cost.
- PhotoKit SHARPENER http://www.pixelgenius.com US$99.95 (Mac/Win, Photoshop plug-in).

Photoshop Actions

On the CD you'll find a few useful Photoshop Actions. To use them:

1. Start Photoshop.
2. Select **Actions** from the **Window** menu. This makes the Actions palette visible.
3. On the Actions palette there's a small right circle button that pops up the palette menu (look at where the cursor is in the example, below):



[168] That's what an Unsharp Mask tool does.

4. Select **Load Actions** and navigate to the BYTHOMACTIONS.ATN file on the CD.
5. The new actions should now appear in the Actions palette. To play one, select it and click the play icon at the bottom of the palette.

Excel Workbooks

On the CD you'll find several Excel workbooks with useful calculators in them:

- *Camera Card Calculations*. This workbook allows you to calculate how much storage you need for a trip or shoot. It's especially useful for calculating how much portable storage you might need for a long trip, such as a vacation or photo tour. The workbook can deal with multiple cameras and a mix of RAW and JPEG shooting.
- *D80 Flash Calculations*. In this workbook you'll find several worksheets that perform useful flash calculations, including red-eye reduction, bounce flash, multiple flash GN, and several others.
- *D80 Macro Calculations*. If you use extension tubes or close up lenses, this workbook has several worksheets that help you deal with the focal length and focus changes, as well as the magnification level.
- *D80 Depth of Field*. You've seen parts of this workbook earlier in this eBook (the Depth of Field Preview section). The actual workbook has Near/Far and Hyperfocal Distance tables in both feet and meters.
- *D80 Pocket Lens Calculations*. This single worksheet is designed for use on a PDA, such as a Pocket PC. It allows you to quickly enter a focal length, aperture, and distance, and for those settings immediately see the near/far and hyperfocal distances in both feet and meters. It's what I use at workshops when helping students work on depth of field issues.

To use any of the workbooks, you'll need Excel or another spreadsheet program that understands the Excel format (the original files were created in Excel 2002):

1. Start Excel.

2. Select **Open** from the **File** menu.
3. Use the **Open** dialog tools to navigate to the CD and select the workbook you want to use.
4. Click the **Open** button.

Within the workbooks, I've consistently used locked cells to keep you from accidentally changing formulas or reference areas. All you have to do is enter new data in the cells that have the light green background and the rest of the worksheet is automatically updated. Note that many of the workbooks have multiple "sheets", which are reached via the tabs at the bottom of Excel's work area.

If you decide to move any of the workbooks to a PDA, you may perform some additional steps. For example, since the workbooks are protected, some PDAs won't let you transfer the file to them until you supply the password. For this eBook, the password for these files is **D80** (note that this password is case sensitive; that's a capital D). Note that you're on your own should you use the password to unlock these files—I can't provide support for modification of these files.

If you have a Palm-based PDA, you may need a third-party product such as QuickOffice to use these workbooks on your device. Also, some products have limitations on the number of characters used in formulas, which may make some of the worksheets fail to work. Again, you're on your own (hint: usually you have to collapse my long variable names to simple cell references; e.g., circle_of_confusion needs to become A4, a reduction of 15 characters).

A Word About Computers

If someone told you (or you assumed) that digital photography was going to be cheaper than regular photography because you didn't have to buy film anymore, you've probably already realized that this advice was wrong. Digital photography has its own needs, and the accessibility of what used to be professional-only capabilities has turned moms, dads,

grandmothers, grandfathers, and even children into would-be digital darkroom aficionados.

Obviously, if you have a D80, you almost certainly have a computer. You may, however, find that your computer needs some massive organ donations to keep up with the new demands you're making of it. In particular:

- *Faster please*. While a 1.4GHz Celeron or 500MHz PowerPC processor worked just fine for word processing, email, and Web browsing, you're going to find that pushing pixels around the screen is going to need all the CPU horsepower you can afford. A 2.8GHz Pentium 4 or 1.6GHz G5 is going to be the very minimum you want if you really get deep into digital darkroom work with D80 images, especially if you ever batch process NEFs or use noise reduction software. (You don't need the fastest processor made for either system; indeed, I'd argue that you should buy one or two steps down and use the money saved on RAM.) Bus and memory speed is also important. That said, the new dual-core Pentiums and the dual-processor Intel-based Macs do have speed benefits with many of the software tools D80 users will use.
- *More please*. Next time Microsoft tells you that Windows runs perfectly fine in 256MBs of RAM, please laugh in their face and suggest they get real [169]. 512MB is the *absolute minimum* you should consider on a Windows machine, but with the D80 1GB is a better minimum, and if you shoot NEF images, I'd even strongly suggest that you consider 2GB [170]. Macintosh users don't fare much better under OS-X, so I'd tend to set the same recommendations. RAM = speed when it comes to pushing pixels around in memory, and that's what digital

[169]Another unreality: Windows users are usually restricted to 3GB or sometimes even less, even if they've installed 4GB of RAM in their computer. That's because Windows still has the legacy problem of assigning working space for the BIOS, video RAM, and possibly other devices. So Windows often ignores your expensive memory, too. 2GB is the correct RAM call for most Windows systems.
[170]Capture NX users really should have 2GB to work on NEF images.

photography is all about. Don't under equip your "enlarger." If you use Photoshop, the more memory you have, the less likely you'll encounter the fate of "dual swapping" (both the OS and Photoshop have their own swap files, and triggering both can cause real slowdowns).

- *Insatiable appetite*. While needing more RAM is required, you'll soon find that needing more disk storage space is even more imperative. I currently have a terabyte of storage space, and feel that is totally inadequate to my needs (not all of my images are currently available at my fingertips). The more you shoot, the bigger the need for permanent storage. Some folk resort to storing photos on recordable CD-Rs (or DVD-Rs these days). While this is a reasonable *backup* solution, it very quickly becomes problematic from an access and searching standpoint, even with catalog programs that can bridge discs. At a minimum, compromise and keep your best images on an available hard drive and archive the rest on archival-quality CD-R or DVD-R media that is run through a cataloging program. Even then, I'll bet you're going to want a 200GB or larger hard drive for images only. Photoshop users are going to want an additional drive so that they can place their Photoshop swap file on a different drive than the OS swap file.
- *More pixels*. Assuming you have enough RAM and you've bought a converter, an image editor, and a cataloging program, having all of them visible at the same time on the screen along with the image you're working on takes up display real estate. And you're going to want a big display to look at your pictures in fine detail as you're

working on them. Or maybe a dual-display set up. Pop for the biggest display you can afford.[171] These days, CRT or LCD doesn't make a big difference, though virtually every serious graphic artist I know pushing pixels still swears that CRTs are more easily calibrated, don't have color shifts due to head position, and are generally easier to evaluate color on. Whatever you get, you'll need a monitor calibration tool for serious work.

- *Put it on paper.* You can't seriously work in digital photography without at least a "proof" printer at your side. Even if you use professional services for final prints, you'll want the ability to run test prints. On the plus side, a decent inkjet printer is very inexpensive these days (compared to the rest of the paraphernalia you'll purchase to support your digital photography habit). On the minus side, ink will cost you a fortune unless you do something about it. Most Epsons can be converted to bottle supplies without voiding your warranty (warning, more equipment cost ahead). But if you do any quantity of printing at all, the cost of a good bottle supply system (~$250) will pay for itself in ink cartridges *very* rapidly.
- *Every port in a storm.* I'm afraid to show you the cable nest coming out of my main work machine. At present it has 4 Firewire and 8 USB 2.0 ports, and every one has something plugged into it. At a minimum, you need a USB port for the camera, a card reader, and a monitor calibration device. These all usually need to be primary ports, not ones on external add-on hubs (sometimes powered hubs work fine, especially on the Mac, but note that Nikon and a few other companies specifically decline to support their devices on hubs). Fortunately, adding

[171]After meeting the above criteria first. I'm tackling these in a logical order. More RAM doesn't fully solve the bottleneck unless you have a processor that can handle moving all those pixels around and a speedy bus (e.g. 800Mhz front side bus instead of 233Mhz). You don't need more hard disk space until you start working with more images (which requires that processor and RAM). As you start working with more images, you'll find that the display could use some "juice." Eventually, this loops back to needing a faster processor.

ports is inexpensive and easy if your computer has an available card slot.

The bottom line, unfortunately, is robust. I know of virtually no one who's seriously started shooting with a Nikon DSLR who hasn't spent more upgrading or replacing their computer equipment than they did on the original camera and lens (and remember, the original D1x was US$4995, so some of those folk had a ways to spend).

You don't have to go over-your-head gaga about this. But do make sure that your computer system is capable of keeping up with your digital photography. To recap, here are two minimum set-ups that should work well:

IBM PC

- 2.8GHz Pentium 4 or faster (AMD Athlon 2400+ or faster); consider dual-core processors
- Fastest bus possible (e.g. 800Mhz front side for Pentiums)
- 1GB RAM or more
- Extra 200GB hard drive for images and Photoshop swap file
- CD-R or DVD-R (or DVD+R or DVD±R) for archiving images
- 19″ monitor (LCD or CRT) or larger
- 3+ free USB ports

Macintosh

- 1.6GHz G5 or faster; any of the Intel-based Macs are fine
- 1GB RAM or more
- Extra 200GB hard drive for images and Photoshop swap file
- SuperDrive for archiving images
- 19″ monitor (LCD or CRT) or larger
- 2 Firewire, 2 USB ports

D80 Accessories

EN-EL3e Rechargeable Li-ion Battery[172]. This lithium-ion battery pack is a custom enclosure with a proprietary connector, and provides 7.4 volts at 1500mAh. The EN-EL3 battery can power the D50, D70, D70s, D80, D100, or D200 body. One EN-EL3e battery is supplied with the D80.

EH-5 AC Adapter. Designed to power the D50, D70 series, or D80, this adapter can be used with voltage sources of 100-240V, with AC cycles of 50 or 60 Hz. Draws 1.2 amps. Provides 9v volts at 4500mA. Separate power cables are available for North America, the UK, Europe, Australia, and Japan, although you can use plug adapters in a pinch. The cable from the AC adapter to the camera is not removable or extendable. Note that when the camera is plugged into an EH-5, the monitor timeouts (10 minute default) still apply!

MH-18a Quick Charger. Designed specifically for the EN-EL3 type battery packs, the MH-18a can charge a fully depleted battery in about two hours. This is the charger that is supplied with the camera, and is designed for the EN-EL3, EN-EL3a, and EN-EL3e batteries. The AC power cable is removable, and the charger can be used with voltage sources of 100-240V, with AC cycles of 50 or 60 Hz.

DK-21 Eyepiece Cup. This small device slides into the viewfinder rails and has a rubber rim to shield the viewfinder from receiving light. If you take pictures without looking through the viewfinder and your camera isn't in Manual exposure mode, you *must* block light coming in through the viewfinder using your hands or the supplied DK-5 eyepiece shutter, which goes into the viewfinder rails in place of the DK-21. One DK-21 is supplied with the D80.

DG-2 Magnifier (requires, and usually comes with, DK-7 Eyepiece Adapter, which slides into the viewfinder rails). An

[172]Third party versions of this battery do not currently exist, but I suspect will at some point.

optional viewfinder extension that magnifies the scene in the viewfinder and provides additional precision in determining focus in macro and telephoto work.

DR-6 Right Angle Viewer. An optional viewfinder extension that slides into the viewfinder rails in place of the DK-21 and allows you to see the scene in the viewfinder at a right-angle. Useful for low-angle, macro, and copy stand work.

DK-21M Magnifying Eyepiece Cup. This small replacement eyepiece slides into the viewfinder rails and has a rubber rim to shield the viewfinder from receiving light. Unlike the regular DK-21, this eyepiece provides a mild magnification that some find useful. However, you may not be able to see the entire image area and viewfinder display information simultaneously using it.

BM-7 LCD Monitor Cover. The clear plastic cover that protects the color LCD from smudges and damage. One is supplied with the D80.

ML-L3 Wireless Remote Control. A battery powered infrared remote control for the D50, D70 series, and D80.

MC-DC1 Remote Control. A simple wired remote for the D70s and D80. Has a lock position for continuous shooting or Bulb exposures. Plugs into a connector currently only available on the D70s and D80 (left side of the body, bottom rubber door on the D80).

Specifications

Feature	*Specification*
Operating temperature	32-104°F (0-40°C)
Operating Humidity	<85%
Sensor Size	.93 x .62″ (23.6 x 15.8mm)
Final Image Size	3872x2592, 2896x1944, or 1936x1296 pixels
Sensor Bit Capture	12 bits
ISO Sensitivity	100-1600 in 1/2, 1/3, or 1 stop increments, 2000, 2500 and 3200 equivalents
File Formats	JPEG (8-bit) and compressed NEF (12-bit)
JPEG Compression	1:4 at Fine, 1:8 at Normal, 1:16 at Basic
Storage Media	Secure Digital (SD) or SDHC
Motor Drive	3 fps, 23 frame buffer (6 with NEF, 100 with most JPEG sizes)
Self Timer	2, 5, 10, 20 seconds
White Balance	Auto, 6 manual modes, 6-step modification, Manual, from picture
Autofocus Detection Range	TTL phase detection using eleven sensors (single area, dynamic, or group)
Autofocus Range	-1 to 19 EV (at ISO 100)
Autofocus Module	Nikon CAM-1000
Autofocus Features	AE/AF lock button, AF lock on partial shutter release, auto area option, viewfinder focus confirmation, wide area or normal central area
Metering Modes	420-pixel matrix, center-weighted (75/25, circle alterable), spot (2%)

Metering Range	0-20 EV (matrix and center-weighted, ISO 100), 2-20 EV (spot metering, ISO 100)
Exposure Compensation	-5 to +5 stops in 1/3, 1/2 or 1 stop increments
Exposure Bracketing	2 or 3 images at increments of 1/3, ½ or 1 stop
Metering Features	User selectable center-weighted area, eleven spot metering areas, spot metering follows focus, AE/AF lock button
Shutter	Mechanical, 50,000 cycle tested
Shutter Speeds	30 seconds to 1/4,000 second, in 1/3-or 1/2-stop intervals, Bulb
Maximum Flash Sync	1/200 second (1/4000 with FP)
Flash contacts	ISO-type hot shoe
Flash Output	GN 42 feet (13m) in TTL
Flash Modes	Balanced Fill Flash (i-TTL); Standard TTL; Commander Mode; Repeating Flash, Manual;
Flash Options	Red-Eye Reduction; Slow Sync; Rear Curtain Sync
LCD Monitor	2.5″ 230k TFT
Playback Functions	Single frame, thumbnail playback (9 images), slide show, histogram (including channel histograms), highlight display, thumbnail playback, magnification of playback image
Viewfinder Coverage	95%
Viewfinder Eyepoint	19.5mm (at –1.0 diopter); 0.94 magnification

Viewfinder Adjustment	-2 to +1 diopters (accessories extend range)
Focus Screen	B-type BriteView clear matte with on-demand E-type grid
LCD Coverage	100% coverage, both dimensions
LCD Protection	nearly transparent BM-7
Video Output	NTSC or PAL (user selectable)
Computer Interface	USB 2
Size	5.2″ wide x 4.1″ tall x 3″ deep (132mm wide x 103mm tall x 77mm deep)
Weight	1 pound 5 ounces (585g) (w/o battery or card)

Getting Service

Assuming that you bought an officially imported camera and not a gray market one, getting service for the D80 should be relatively straightforward. In practice, both Nikon and users make it more difficult than it should be.

I won't go into the gray market problem here (see http://www.bythom.com/warranty.htm), as it's an entirely different issue and varies considerably in how it's handled around the world.

The real problem is that users and Nikon both make assumptions that sometimes are contradictory. Here are the major problems I keep hearing from Nikon users who have troubles with NikonUSA and a few of the other subsidiaries:

- *Not under warranty*. Unless NikonUSA receives a copy of the warranty card *and* a copy of a dated sales receipt showing the purchase of the item in question, they typically assume that product is *out* of warranty. (Tip: *always* get the store to put the serial number on the invoice). Registering your product on Nikon's Web site or sending in the Product Registration card is not enough. Unfortunately, there isn't a clear "warranty card" that comes with the D80 in the US. Thus, that dated sales receipt is even more important, as it's the only official document that Nikon accepts.
- *Second-hand purchase*. Nikon warranties aren't transferable. Again, that purchase receipt is important.
- *Impact damage*. Don't try to fool Nikon and claim your camera doesn't focus and that it should be repaired under warranty after you dropped it and bent the lens mount. Some problems simply occur only because of poor user handling (bent aperture arm and lens mount being two obvious ones). But don't allow multiple problems to be grouped automatically by Nikon under impact damage. If your camera had a persistent card writing problem before you dropped it and damaged the lens mount, make sure

that Nikon knows that and that you expect them to fix *that* problem under warranty.

- *Slow service*. With new products, service usually slows for all but NPS members (professional photographers). Even NPS pros sometimes encounter parts shortages that delay repairs. But a more frequent problem is that Nikon didn't get all your information and/or is waiting for something from you (repair authorization, proof of purchase, shipping address, etc.). We'll deal with that further down in this section.
- *Problem not repaired*. A frequent complaint goes something like this: the user sends Nikon a camera body with the complaint that focus isn't accurate; Nikon puts the camera on their test station and finds it is within tolerance, Nikon sends the camera back to the user without changing anything, so the user complains that the camera wasn't repaired. You won't like hearing this, but that's your fault if it happens to you (I'll tell you how to avoid it in a moment).
- *Small part = expensive repair*. Most repairs require tear down of at least part of the camera and quite a bit of testing time. Beyond that, most parts are replaced modularly (e.g. you get an entire new shutter, not just one piece of it, or, heaven forbid, you often get an entirely new sensor and filter assembly if you break the filter).
- *Where'd it go?* NikonUSA ships to street addresses only. Sometimes people wait for return of their product while Nikon waits for a street address instead of a PO Box.
- *Diagnosis overload*. Once Nikon opens up a camera to be repaired, they diagnose all problems that would need to be fixed to return the camera to factory specifications. Thus, you might send the camera in to be fixed under warranty for a shutter problem and discover you're going to be billed for impact damage on a bent lens mount. You probably want that fixed, but since you weren't expecting to have to approve an estimate for repair costs, you never followed up with Nikon in a timely fashion and your camera sits waiting for authorization.

Okay, now that I've scared you, how do you get quick and complete service out of Nikon? Here's my list, compiled after talking and corresponding with dozens of users who've had troubles with NikonUSA service:

- *Document.* Take the time to write a clear, complete, and if appropriate, illustrated letter that describes *exactly* the problem you've encountered. If the problem intersects image quality, send a printout of an image that clearly shows the problem. In extreme cases, I'd send a file on CD, as well. What kinds of things am I talking about? Dead pixels, excessive hot pixel problems, other image artifacts, side-to-side focus problems, blank or incorrectly written images, and so on. Don't write a novel; make your note concise and to the point. If you have an expectation, state it. If you included anything other than the item you want repaired, list those things in your note, along with all serial numbers.
- *Provide.* Find the original warranty form if the product came with one, make a copy of the purchase invoice for the product, and staple them to the note you wrote. **Provide these items even if the product is out of warranty!** Make sure the serial number is visible on all of these things and matches the item you're sending in! If the item has been repaired within the last three months, let Nikon know and provide a copy of anything you received back with that previous repair. Nikon doesn't provide a form to fill out to consumers, so I've taken the liberty to paraphrasing the form they give to NPS members and have included a PDF of it on the CD (the file name is Nikon Repair Request).
- *Include.* If the problem is exhibited with a particular accessory, you need to send the accessory! Got external flash problems with your D80? Send the camera *and your* flash. Got focus problems? Send the camera, a lens that triggers the problem, *and* a photo that shows the resulting out-of-focus image problem. Note that if you send an accessory like this, you need to provide the warranty form

and purchase invoice for it, too! (And don't send third-party flash units and lenses to Nikon; obviously, they don't warranty those.)

- *Strip*. Don't send the battery (unless you're having power problems), don't send your storage card (unless you're having trouble writing to it and it's one of Nikon's tested ones), and don't send your neckstrap. I actually get a bit overboard here: I take off the eyecup and color LCD protector. On the flip side: *do* put the body cap on.
- *Be accessible*. Nikon's NPS repair request form has places for home phone, work phone, fax, and email address. Seems like a good idea to provide them, but I go even further: I tape a business card to the camera. Also, PO Boxes are no-no with Nikon: give them a street address to ship back to.
- *Follow up*. In the US, that usually means phoning or checking the Web site that Nikon will point you to once they receive and log your item into service. Be sure you have any number Nikon provides you, along with the serial numbers of the items you sent.
- *Authorize*. If your repair is going to cost you something (as in the case of impact damage), you're at some point going to need authorize payment. Usually you should wait for Nikon to ask for it. But if you want to expedite the process, write a note that says "I hereby authorize Nikon to make any repair of up to US$xxx and charge this to my Mastercard/Visa ####### expiration x/xx." (Note that I put a spot for that on my form.) ***You must sign this authorization***. (Nikon will also ship COD, though this is always sent UPS Second Day delivery in the US.)

By now you're probably wondering about how you get in touch with Nikon service. After all, the phone number is conspicuously missing from the materials provided with the camera. In the US, call 1-800-NIKON-SV (that's 1-800-645-6678 if you've still got a rotary phone that doesn't have the letters on it). Foreign readers will have to consult the Web site for their local distributor. I once tried to put every number

worldwide into one of my books, but some of them changed so rapidly, it became a chore to stay up to date.

In the US, your equipment will need to be sent to:

Nikon Inc.
Attn: Service Dept.
1300 Walt Whitman Road
Melville, NY 11747-3064

Or

Nikon Inc.
Attn: Service Dept.
841 Apollo St. Suite 100
El Segundo CA 90245

Questions and Answers

Q: *Are there different models of D80 in different parts of the world?*
A: No. A D80 body sold in the United States is the same as the camera sold in Japan and Europe. The serial numbering method does seem to vary between regions, however (which is one way that Nikon can tell whether you've got an official import or gray market camera, by the way). Servicing and warranty policies tend to vary between countries and regions. Note that some gray market importers "strip" items out of the box Nikon provides in order to offer a "lower price." It's always a bad sign if the retailer asks you if you want a battery, body cap, charger, eyepiece, or any other normally supplied accessory. NikonUSA *will not* repair a gray market camera, and such "add-on scams" are your first sign that you're getting one.

Finally, note that Nikon produces different D80 "kits" that consist of the camera and one or more lenses.

Q: *How can I tell if I'm getting an officially imported D80?*
A: There's no simple way, unfortunately. In the US, the serial number (at least until they run out of numbers), should be in the form 30#####. That's not a perfect method of determining origin, though.

Q: *Can I have older manual focus lenses modified to work better with a D80?*
A: With a few minor caveats, yes. First, if the lens is pre-AI, you should have the lens converted to AI (see http://www.aiconversions.com). Once the lens is AI-compatible, you can mount and use it on the D80. To get the lens to meter you must add what Nikon calls a "CPU chip" to the lens. I used to point out a service that installed CPUs into lenses, but I've received just enough complaints about that vendor that I no longer can recommend them. If you know what you're doing, it's relatively easy to order a CPU from Nikon and install it in the mount yourself. But remember, you

can always shoot in Manual exposure mode and refine your exposure by looking at the histogram.

Q: *What's the CPU that Nikon keeps referring to in lenses? Do Nikon lenses really have a computer in them?*
A: No, there's not really a computer in Nikon lenses. There is a small chip that provides two or three pieces of information to the camera: the maximum aperture, the focal length, and (on D-type and later lenses) a broad indication of the focus distance currently set. (The focus distance is not exact, but rather one chosen from a small set of possible distances.) Is it really important to use D-type lenses on a D80? If you use flash at close-in distances, yes. With a lens of less than 100mm in focal length and at focus distances of 15 feet (5m) or less, you'll see small, but usually visible differences in flash exposures between non-D and D-type lenses in TTL flash modes. With longer focal length lenses and longer focus distances, flash exposures don't vary much, if at all. In non-flash exposures, you won't see any dramatic differences in exposures between non-D and D-type lenses at the same focal length and focus distance, despite Nikon's claims for improved "3D matrix metering." I have seen some small differences, though, especially with really wide angle lenses focused at close distances. What *does* make a difference for both flash and non-flash use is the maximum aperture information, which is required for the D80 to provide Program and shutter-preferred exposure modes, as well as matrix metering.

Q: *Is it safe to let the D80 and Secure Digital cards go through airport X-ray machines?*
A: Yes, though the camera should normally be turned OFF before doing so. The danger is not the X-ray itself (as it is with film), but that these devices tend to have strong magnetic fields associated with them. But the brief exposure in any X-ray machine, especially the relatively low-powered ones used in the United States, shouldn't have any impact on the camera or the Secure Digital media. Likewise, your computer equipment shouldn't have problems with X-ray machines, either.

Q: *I've seen Secure Digital cards marked with 80x or even 150x speeds. How do I tell which cards are the fastest?*
A: First, Lexar and others use those labels in reference to the peak access speed of a CD-ROM drive. In other words, an 8x Secure Digital card isn't necessarily half as fast as a 16x card, though it may be true on the D80 if the card itself can handle sustained peak writes. Virtually all of the actual memory chips used in Secure Digital cards are produced by a small handful of manufacturers, and the technical specifications differ little between them. Lexar first made improvements in write speed by implementing an "erase-ahead" function, not by using faster chips. That said, field-testing has shown that the range between various Secure Digital cards can be somewhat dramatic between the lower cost generic cards and state-of-the-art brand name cards. A very good report on a reasonable selection of different cards can be found at http://www.robgalbraith.com. Rob's results very much mimic mine, and his database of cards is larger than mine and kept more up-to-date, so his site is the preferred source for card speed info.

Q: *Are there any underwater housings for the D80?*
A: Not as I write this, however I expect there to be several within the next six months. If you're a serious underwater photographer, you'll want to watch the news at http://www.wetpixel.com for housing announcements.

Q: *Can I attach a bellows unit to the D80?*
A: Yes. The Nikon PB-6 bellows can be attached by using a compatible extension ring (PK-11a, PK-12, PK-13, or PN-11) between the bellows and the camera. Nikon also warns that you may need the PB-6D bellows spacer for some situations. Note that all of these devices are AI compatible, but that means that metering is turned off on the D80. If you use an MB-D80, you may need to increase the extension between body and bellows to clear the front grip of the MB-D80.

Q: *Can the D80's software be upgraded?*
A: Yes. As I write this, there have been no updates.

Q: *Can the D80's sensor be upgraded later?*
A: Not likely. Such a change would require a pretty drastic disassembly, removal and realignment procedure, and the supplemental electronics might need to be replaced, too. The likelihood of that being done at a reasonable cost is low, so it's more likely that a replacement camera model would appear instead. Nikon has been on about eighteen month cycles with their consumer models. Any D80 replacement wouldn't appear until 2008 or 2009 based upon current Nikon cycles.

Q: *Is there a software development kit (SDK) available to deal with communication to and from the camera and the NEF file format?*
A: Yes. You can apply to Nikon for access to some key header files and other information, including DLLs that operate as "black boxes" between your software and the camera or NEF images. Some developers find it easy to get, others difficult (and it varies between Europe, the US, and Asia). You'll also need to sign a license agreement to get the SDK. Nikon also produces a "mini-SDK" that allows access to the encrypted white balance for NEF files.